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Perceived Effectiveness of BSWM's Institutional Support to Pilot Small Water Irrigation System Associations (SWISAs)

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Abstract

The objective of this study was to assess the perceived effectiveness of institutional support of the Bureau of Soils and Water Management (BSWM) to pilot Small Water Irrigation System Associations (SWISAs) in Luzon. SWISA is an association of organized farmer-beneficiaries of Small-Scale Irrigation Projects specifically for community-managed Small Water Impounding Project and Diversion Dam. Institutional support provided to SWISAs are facilitated by contracted CDOs assigned in regions. Correlational research design was used in the study. Of the 22 pilot SWISAs with 520 farmer members, 226 respondents were identified. The respondents were selected from the members of active pilot SWISAs with an operational irrigation system for at least three years. Based on the results of this study, as the level of participation of SWISA members in the organizational undertakings, operation and maintenance activities, and implementation of activity plans increases, the perception of effectiveness of BSWM's institutional support to pilot SWISAs also increases. Moreover, as the level of understanding of CDOs of their roles in conducting organizational and monitoring activities, capacity enhancement, and coordinating activities increases, the perception on the effectiveness of the provided extension support also increases. Hence, generating the actual needs of farmers and the continuous strengthening of extension staff are necessary for the effective implementation of institutional program.

Keywords: *perceived effectiveness, institutional support, irrigation system association*

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Introduction

In agriculture sector, institutional intervention is an integral part of government projects sustainability. In the case of community-managed irrigation systems, it has been held necessary more than ever to organize and empower water users through institutional development and capacity building to strengthen irrigators associations' capability to undertake their own development and effectively manage the operation of irrigation systems.

In the Philippines, since 1980's the Department of Agriculture-Bureau of Soils and Water Management (DA-BSWM) in partnership with the DA-Regional Field Offices (DA-RFOs) and Local Government Units (LGUs) have been implementing Small Scale Irrigation Projects (SSIPs) to augment water supply in upland areas. SSIPs are granted by the government and turned over to the farmer beneficiaries for their operation and maintenance. Among these SSIPs are rainwater harvesting facilities such as Small Water Impounding Project (SWIP) and water diverting structures like Diversion Dam (DD). SWIP and DD are community-managed, the farmer beneficiaries are organized into an association known as Small Water Irrigation System Association or SWISA. The institutional development which focuses on strengthening of SWISAs to ensure cohesion among water users and sustain the operation and maintenance of the irrigation system is mainly undertaken by the BSWM.

However, although SWISAs were capacitated on proper operation and maintenance (O&M) of irrigation facilities as well as on how to run the affairs of their association, the result of national inventory of SSIPs conducted in 2013 by the BSWM and DA-RFOs which aim to document and determine the status of the irrigation system and farmers' association showed that the number of active SWISAs were significantly declined. It was identified that the nonfunctioning of farmers' associations was generally caused by inconsistent monitoring and institutional support to farmers' associations. Also, according to the report, 50% of SWIPs and DDs needed major and minor rehabilitation. It was noted that these non-operational and partially operational SWIPs and DDs have inactive SWISAs. As ascertained by the study conducted by Contreras et al. (2013), one of the constraints that negatively influence operational status of irrigation infrastructures is institutional in nature, the weak and inactive farmers' associations.

Hence, the establishment of SWISA pilot sites was initiated in 2014. With the assistance of contracted Community Development Officers (CDOs) assigned in regions, selected pilot SWISAs were: (a) regularly monitored; (b) facilitated in conducting institutional activities (i.e., meetings, election of officers, O&M of system etc.); (c) guided in implementing and adoption of SWISA activity plans. Aside from these, assistance in requesting and acquiring interventions/supports (i.e., farm machineries, inputs, livelihood programs etc.) from other government agencies were provided to SWISAs.

The BSWM in partnership with SSIP implementers (i.e., DA-RFOs and LGUs) are continuously constructing SSIPs such as SWIPs and DDs nationwide. Several research have been conducted in evaluating the technical performance of SSIPs which focuses on the infrastructure development component of the government irrigation program. On the other hand, there were insufficient studies particularly on the extension support, education, and training services aspect relative to the implementation of SSIPs.

According to Harun and Ariff (2017), the success of institutional support is very much dependent on the targeted group, as such, the BSWM continuously provides interventions to SWISAs for them to

become a strong and viable organization. As of December 2020, a total of 77 SWISA Pilot Sites were established in 15 regions of the country (WRMD Yearend Report, 2020). However, no study has been conducted yet to assess the perceived effectiveness of BSWM's institutional support to these SWISA pilot sites.

This study is essential to assess the status of SWISAs farmer members after establishment as pilot sites to determine the effectiveness of institutional development interventions to strengthen and make the SWISAs a viable farmers' association. This study also is geared in evaluating the level of participation of SWISA members and their perception on the role of CDOs and how this variables affect the perceived effectiveness of the established SWISAs. The assessment may contribute to the planning and policy making of SSIP implementing agencies on institutional development and capacity building for project sustainability.

Materials and Methods

The study was conducted from July to December 2022 to selected pilot SWISAs in Luzon covering Cordillera Administrative Region, Ilocos Region, Cagayan Valley Region, Central Luzon, CALABARZON, MiMaRoPa, and Bicol Region. The respondents were selected based on BSWM's inventory as of December 2020. Stratified random sampling was applied in selecting respondents of the study. From the list of established pilot SWISAs in Luzon, 22 active pilot SWISAs with operational irrigation systems for at least 3 years were selected with a total farmer members of 520. Using Cochran's Formula, with 5% margin of error, 226 farmer-respondents were identified.

Initially, the researcher coordinated with the BSWM-Water Resources Management Division pertaining to the conduct of the study and data collection. The researcher requested the assistance of CDOs assigned regions in acquiring data and documents relative to the established SWISA pilot sites. Prior to the conduct of data collection, communication letters requesting permission were sent to Regional SWISA Presidents in CAR and Regions I to V. With the assistance of CDOs, Barangay Officials and individual SWISA Presidents were briefed regarding the conduct of the study. The participants' involvements were voluntary, and they were assured that the data gathered would be treated as confidential and to be used for research purposes only.

Correlational research design was used in the study. The survey questionnaire was validated among 30 SWISA farmers who shared the same characteristics but were not included as respondents of the study. The results of the Cronbach's Alpha test were as follows: level of participation of SWISA farmer members - 0.930; role of assigned CDO – 0.933; and perceived effectiveness of BSWM's institutional support to pilot SWISAs – 0.952, suggesting that the items have strong internal consistency which means it is considered acceptable. The validated survey questionnaire was used in gathering data. The five-point Likert Scale was used in determining the perceived level of participation of SWISA farmer members, role of assigned CDOs, and perceived effectiveness of the BSWM's institutional support to pilot SWISAs. The data were quantified and interpreted using statistical techniques which includes percentages, frequencies, means, standard deviations, and Pearson's Product Moment Correlation.

Results and Discussion

Socio-Demographic of SWISA Farmer Members

The socio-demographic characteristics of SWISA farmer members of SWISA was presented in Table 1. Majority (53.1%) of the respondents were middle-aged adults belonging to the age range of 36 to 55 years old. This indicates that respondents are in their physically abled stage to carry out strenuous farm work. The result is relatively close to the findings of Palis (2020) that most of the farmers in the Philippines were middle-aged with ages ranging from 50-59 years. Farmer members were dominated by men (181 or 80%). The same finding is revealed in the study of Torres et al. (2014) where association or cooperative farmer members in Luzon were dominated by men. However, although majority of members were males, it was noted in the study that women occupy key positions in the association, hence, they are involved in governing the association.

Also, majority of SWISA members were married with 88.5%. Likewise, in the recent study of Pintor et al. (2023) majority of the farmer members of irrigators association in Negros Occidental were also married comprising 64.5%. A high portion of SWISA farmers were high school graduates with 35.8%. This is supported in the study of Briones (2017) in the Philippine Institute for Developmental Studies that majority of agricultural workers (farmers) in the Philippines have finished at least secondary school. With SWISA farmer members' level of education, it is a good indicator that they can adopt new information and technology.

Table 1

Socio-Demographic Characteristics of SWISA Farmers

Category	Frequency	Percentage
Age		
Young adult (18-35)	21	9.3
Middle-aged adults (36-55)	120	53.1
Older adults (56 and above)	85	37.6
Sex		
Male	181	80.1
Female	45	19.9
Civil Status		
Single	16	7.1
Married	200	88.5
Separated	2	0.9
Widow/Widower	8	3.5
Educational Attainment		
No formal education	3	1.3
Elementary undergraduate	24	10.6
Elementary graduate	52	23.0
High school undergraduate	33	14.6
High school graduate	81	35.8
College undergraduate	10	4.4
College graduate	18	8.0
Others	5	2.2

*n=226

Level of Participation of SWISA Farmer Members

The SWISA farmer members level of participation in terms of organizational, and operation and maintenance (O&M) activities is presented in Table 2. SWISA farmer members *always* participate in the regular cleaning of canals and clearing of debris in the dam (mean=4.52; SD=0.60) and minor repairs of dam (mean=4.48; SD=0.70). As stated by SWISA Officers, they perform regular system work maintenance or '*bayanihan*' and they imposed penalties to non-participating members. This suggests that aside from understanding their roles, SWISA members also recognize the importance of system maintenance and enforcement of fines when they neglect participating in their activities. The same was observed by Chen *et al*. (2023) in China wherein imposing penalties among farmers resulted to a significant positive effect on their behavior and willingness to participate in the program.

Table 2

SWISA Farmer Members' Level of Participation in Terms of Organizational and O&M Activities

Organizational and O&M activities	Mean	Standard Deviation	Verbal Description
I attend regular and assembly meetings	4.50	0.69	Always
I pay operation and maintenance fee, dues and other fees regularly and timely	4.38	0.63	Always
I participate in regular cleaning of canals and clearing of debris in the dam	4.52	0.60	Always
I participate in minor repairs of dam	4.48	0.70	Always
I participate in the maintenance activities being conducted in the watershed area such as tree planting	4.01	0.81	0ften
Weighted Mean	**4.38**	**0.69**	**Always**

Legend: 4.21-5.00 Always 3.41-4.20 Often
2.61-3.40 Sometimes 1.81-2.60 Seldom
1.00-1.80 Never

On the other hand, respondents *often* participate in the maintenance activities in the watershed area (mean=4.01; SD=0.81) since landowners of the watershed area are non-members and involving them in watershed management have been a challenge for SWISAs. The same issue was determined by Rola et al. (2004) in implementing watershed management program in Lantapan, Bukidnon. This implies the need for stakeholders' consultation with the assistance of national and local government agencies (i.e. DA, DENR, LGUs) for the implementation of development activities in the watershed area.

In terms of SWISA farmers participation in the implementation of activity plans (Table 3), farmer members *always* take part in decision-making (mean=4.63; SD=0.66), preparation of plans (mean=4.59; SD=0.71), and on consultation meetings (mean=4.56; SD=0.73). This means that prior to the implementation of SWISA activity plans, it is properly coordinated and consulted with the farmer members. As it has been observed, the farmers' involvement in all stages of implementation resulted to a more functional irrigation systems than without consultation and participation of water-users (NIA, 2023).

However, they *often* follow the implementation of Watershed Management Plan (mean=4.06; SD=0.80). This resulted by the often conduct of watershed maintenance activities by farmers due to private land ownership of watershed areas by non-members of SWISA. Similarly, farmers *often* follow

the Cropping Calendar Plan (mean=4.18; SD=0.72) due to unpredictable rainfall and extreme weather events. This situation was also observed in the study of Peñalba et al. (2012) in Batangas, Rizal and Quezon wherein all small-scale irrigators associations stated that the onset of rainy season relative to their usual cropping calendar has changed (either delayed or advanced), hence, they adjust their cropping period.

Table 3

SWISA Farmer Members' Level of Participation in Terms of Implementation of Activity Plans

Implementation of activity plans	Mean	Standard Deviation	Verbal Description
As SWISA members, we are involved during the consultation meetings with BSWM prior to the development of SWISA plans	4.56	0.73	Always
We participate in the preparation of plans	4.59	0.71	Always
We are involved in the decision-making	4.63	0.66	Always
Our suggestions on the implementation of plans are being solicited and considered	4.54	0.72	Always
I follow the schedule of land preparation every cropping season (Cropping Calendar Plan)	4.18	0.72	Often
I follow the crops to be planted during wet and dry season (Cropping Pattern Plan)	4.30	0.85	Always
I follow plan on efficient water distribution such as scheduling (Water Distribution Plan)	4.41	0.82	Always
I follow regulations and activities in maintaining and sustaining the efficient operation of the irrigation system (Maintenance Plan)	4.49	0.69	Always
I follow plan in the management of watershed area (Watershed Management Plan)	4.06	0.80	Often
I follow the association's way in managing conflicts (Conflict Management Plan)	4.42	0.68	Always
Weighted Mean	**4.42**	**0.74**	**Always**

Legend: 4.21-5.00 Always 3.41-4.20 Often
2.61-3.40 Sometimes 1.81-2.60 Seldom
1.00-1.80 Never

Generally, high level of participation was observed in terms of organizational and O&M activities (weighted mean=4.38; SD=0.69) and implementation of activity plans (weighted mean=4.42; SD=0.74) as shown in Table 4. As inferred by Ros (2010) study in Cambodia, farmers' participation in association's management, enforcement of rules and irrigation O&M schemes is influenced by the benefits they obtained. Hence, SWISA farmers participate to take advantage of the associations' services and government interventions resulted with a grand mean of 4.40 (SD=0.72)

Role of Community Development Officers

In the implementation of institutional development programs to farmers/irrigators' associations, the role of BSWM's Community Development Officers (CDOs) is similar to NIA's Irrigation Development Officers such as to provide assistance in the organization and registration of farmer-beneficiaries of

irrigation projects; monitor associations' activities and projects; provide capacity building/training activities; and establish linkages with other agencies for other programs and services (NIA, 2023).

In this study, the roles of CDOs were measured using set parameters. Relative to organizational and monitoring activities, it was measured based on the CDOs roles in organizing farmer beneficiaries, facilitation of election of officers, registration of SWISA, regular monitoring (i.e., organizational activities, operation of irrigation system, financial status, O&M activities, water distribution) and determining the needs of SWISAs. In terms of capacity enhancement, it was assessed particularly on the conduct of Basic Leadership and Technical skills training, evaluation of training result, and following up of technical training output. As to coordination activities, it was gauged per CDOs assistance in the reporting of operational status of irrigation system and SWISAs concerns, collaboration with LGUs, coordination of activities/events, following up of requests, and linking SWISAs to other government agencies.

Regarding the roles of CDOs in the organizational and monitoring activities, it was noted in the study that CDOs prioritize registration of SWISAs after the organization of SSIP farmer beneficiaries. In monitoring the conduct of SWISA activities and status of irrigation system, CDOs regularly check not just the organizational undertakings but also the operational status of the irrigation system. While in checking the financial status and determining needed intervention of SWISA, the result suggests that these are periodically check by CDOs during field monitoring. It is evident that farmer members recognize CDOs' exemplary performance of their role in organizing and monitoring SWISAs. This is contrary to the conclusion of Sennuga et al. (2020) in which small holder farmers in Sub-Saharan African Communities have an unfavorable perception of the performance of agricultural extension agents.

As stated in the National SSIP Master Plan (BSWM, 2014), Community Development Officers shall facilitate the conduct of on-site training program to farmer beneficiaries to develop capacities of SWISAs on the O&M of their SSIPs, improve their leadership capability, and enhance their technical know-how on crop production. In this study, a high rating was observed on the role of CDOs in capacitating SWISA farmers. The result is contrary to the findings of Managanta (2020) in which extension workers in Indonesia have a weak role in increasing the competence of farmers.

It is clearly stipulated in the Republic Act No. 7607 known as the "Magna Carta of Small Farmers" that the extension workers of the Department of Agriculture shall serve as linkages between the small farmers and farmers' organizations. Hence, Community Development Officers of DA-BSWM undertake the role in coordinating the support and services needed by SWISAs. It was noted in the study that CDOs reports to BSWM their issues and concerns such as right of way (ROW) problem and water right conflicts. Based on the activity reports of Water Resources Management Division of BSWM, SWISAs' concerns on ROW and water rights were regularly reported by CDOs during the assessment on the Extension Support Education Training Services of the DA Rice Program. As to linking SWISAs to other government agencies for training and livelihoods, SWISA farmers stated that they have received more trainings on farm and irrigation management than livelihood seminars/programs. This implies the need for a strong partnership with DOLE, DSWD and other institutions in providing livelihood opportunities to SWISA farmers.

Table 4

SWISA Farmer Members' Perception on the Role of CDOs

Role of Community Development Officers	Weighted Mean	Standard Deviation	Verbal Description
Organizational and monitoring activities	4.62	0.55	Strongly Agree
Capacity enhancement	4.62	0.61	Strongly Agree
Coordinating activities	4.43	0.65	Strongly Agree
Grand Mean	**4.56**	**0.60**	**Strongly Agree**

Legend: 4.21-5.00 Strongly Agree 3.41-4.20 Agree
2.61-3.40 Neutral 1.81-2.60 Disagree
1.00-1.80 Strongly Disagree

Overall, as presented in Table 4, the roles undertaken by Community Development Officers in terms of organizational and monitoring activities (weighted mean=4.62; SD=0.55), capacity enhancement (weighted mean=4.62; SD=0.61) and coordinating activities (weighted mean=4.43; SD=0.65) were very satisfactorily perceived by the respondents with a grand mean of 4.56 (SD=0.60). This result is comparable to the findings of Saridewi et al. (2020) in Indonesia where farmers are generally very satisfied with the activities carried out by extension workers. Moreover, as cited in the study of Mwamakimbula (2014), the role of extension agents is affected mainly by the characteristics of their employing agency and the clientele they served. Given the result of this study, it implies that CDOs are supported and capacitated well by BSWM and trusted by SWISAs which resulted in the positive perception on their performance.

Perceived Effectiveness of BSWM's Institutional Support to Pilot SWISAs

In the study of Luyun and Elazegui (2020), one of the factors used in evaluating the effectiveness of government irrigation programs in the Philippines was the institutional aspect of performance of communal irrigation systems. In this study, perceived effectiveness of institutional support by farmer beneficiaries of SSIPs was measured according to the set parameters: (a) SWISA organizational, registration and monitoring; (b) trainings conducted; and (c) SWISA plan implementation.

The perceived effectiveness of SWISA organization, registration, and monitoring was rated by the respondents based on how effective is the BSWM's assistance in registering SWISA to SEC/DOLE/CDA to become a formal association and in availing government interventions or projects, and the regular monitoring in the continuous conduct of SWISA activities, sustaining efficient operation of the irrigation system and assessing the needs of SWISAs.

The BSWM's assistance in registering SWISA to SEC/DOLE/CDA to be a formal association and in availing government interventions were highly rated by the respondents. The result of the study confirms the claim below.

As cited by a SWISA farmer,

> *"Dahil sa SWISA, maraming tulong ang naipaabot sa amin ng gobyerno. Nagkaroon kami ng SWIP at concrete canal na nagpataas ng aming ani at nabigyan din kami ng mga makinarya para mapadali ang aming pagsasaka, sa tulong 'yan ng DA at BSWM*

> (Because of SWISA, we have received various government interventions. We are granted with government projects such as SWIP and concrete canal, and farm machineries through DA and BSWM)".

In terms of trainings conducted, its effectiveness were evaluated based on how effective are the Technical Skills Training in enhancing your knowledge on good farming practices, Basic Leadership Skills Training in increasing the active participation of members to SWISA activities, technical training in increasing yield through learned proper land preparation and irrigation, institutional training in building good relationship among SWISA officers and members, leadership training in capacitating SWISA Officers on how to perform their duties and responsibilities, and institutional development trainings in achieving the goals of SWISA to become strong and viable organization.

The results on the effectiveness of farmers' trainings implied that it not just improves the institutional but also the technical aspects of SWISAs. Likewise, in the study of Noor and Dola (2011) in Malaysia majority of the respondents agreed that training programs are useful and made them a better farmers. But for the leadership training, the result suggests that more in-depth training on the roles of SWISA officers is needed.

The effectiveness of SWISA plans implemented was assessed by rating how effective are the Cropping Pattern and Calendar Plan in the timely preparation of field and seed material, Water Distribution Plan in the proper and equal distribution of water to the fields, Maintenance Plan in sustaining irrigation system operation, Watershed Management Plan in maintaining or rehabilitating the watershed area, and Conflict Management Plan in managing and resolving conflicts accordingly and more quickly.

Based on the result, effectiveness of the Maintenance Plan, Water Distribution Plan, and Cropping Pattern and Calendar Plans were the most highly rated plans by the respondents. These three (3) SWISA plans are interrelated with each other. The crops to plant and the dates of planting as reflected in the Cropping Pattern and Calendar Plan is the basis of irrigation schedule as specified on the agreed Water Distribution Plan, and to attain said plans the proper maintenance of irrigation system is needed, hence, the development of Maintenance Plan. This accounts to the high rating generated on these plans.

Additionally, as to Maintenance Plan which has the highest rating suggests that it is useful in undertaking maintenance activities and identifying maintenance requirement of the irrigation system. Also, with this plan irrigation system design lifetime will be achieved (Enciso-Medina et al., 2011). This implies that with the proper implementation of Maintenance Plan, SWISA farmers will be able to continuously generate benefits from their SWIP/DD, and the irrigation system will probably live out its projected period of use (25 years). However, lowest rating was observed in the implementation of Watershed Management Plan, as found out in the study of Luyun and Dulce (2020), the irrigators associations have none or limited role in the watershed management of communal irrigation systems.

The perceived effectiveness of BSWM institutional support to pilot SWISAs is shown in Table 5. Result shows that SWISA organization, registration, and monitoring are perceived by the respondents as *extremely effective* with a weighted mean of 4.61 (SD=0.62). With the noted assistance of assigned CDOs in the regions, SWISA farmers were able to regularly conduct association's activities and maintain the operational status of their irrigation system. This highlights the importance and effectiveness of constant monitoring and focused institutional development of BSWM to pilot SWISAs.

Table 5

Perceived Effectiveness of BSWM Institutional Support to Pilot SWISAs

Category	Weighted Mean	Standard Deviation	Verbal Description
SWISA organization, registration and monitoring	4.61	0.62	Extremely Effective
Trainings conducted	4.63	0.62	Extremely Effective
SWISA plans implementation	4.49	0.75	Extremely Effective
Grand Mean	**4.58**	**0.66**	**Extremely Effective**

Legend: 4.21-5.00 Extremely Effective; 3.41-4.20 Very Effective; 2.61-3.40 Moderately Effective; 1.81-2.60 Slightly Effective; 1.00-1.80 Not at all effective

It is evident as shown in Table 5, that farmer members are satisfied with the trainings provided rated as *extremely effective* (weighted mean=4.63; SD=0.62). The result of the study signifies that the aim of BSWM in providing quality and sustainable trainings are met. As inferred in the study of Miiro et al. (2014), rural service providers who build capacity of local organizations can consider the aspect of high satisfaction rating of farmer members to government support (in this case BSWM institutional training support) to pursue certain strategic human level organizational outcomes by manipulating transfer system factors such as providing feedback and supportive resources to help trainees.

Concerning the SWISA plans implemented, it can be derived, as has been claimed earlier, that the farmer members are satisfied as to how plans were transformed to actual implementation with a weighted mean of 4.49 (SD=0.75).

Overall, SWISA farmer members perceived BSWMs institutional support as *extremely effective* with a grand mean value of 4.58 (SD=0.66). The result of the farmer respondents' assessment conforms to the findings of Luyun & Elazegui (2020) wherein majority of members of irrigators association in Luzon rated excellent on the assistance they received. This strengthened the position of BSWM that the institutional support was carefully planned before bringing it to the SWISA farmer members.

Relationship between Level of Participation of SWISA Farmer Members and Perceived Effectiveness of the BSWM's Institutional Support to Pilot SWISAs

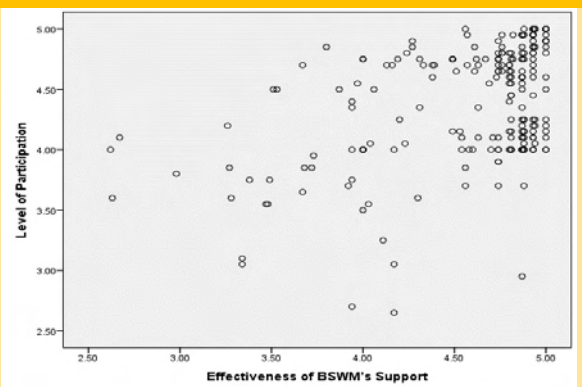
The result of the study shows that there is a highly significant relationship *(p*-value=0.001*)* between the level of participation and perceived effectiveness of BSWM's institutional support. Result shows a low positive correlation (*r*=0.447) between the two variables. The coefficient of determinants (r^2=0.200) suggests that 20% of the variability of the effectiveness of BSWM's institutional support can be explained by the level of participation. The correlation observed between the level of participation and perceived effectiveness of BSWM institutional support implies that the objectives of BSWM in this area were achieved, thus, its programs and activities are responsive and proactive to the needs of its clientele.

Figure 1 shows that as the level of participation increases, the perception on the effectiveness of support also increases. It, therefore, suggests that the level of participation sets the perceived effectiveness of institutional support. This claim is supported by the study of Paje (2021) suggesting that

to yield positive effects of institutional support, every member should take part in all the programs and projects implemented.

Figure 1

Scatter Plot for the Relationship of Level of Participation and Perceived Effectiveness of BSWM's Institutional Support

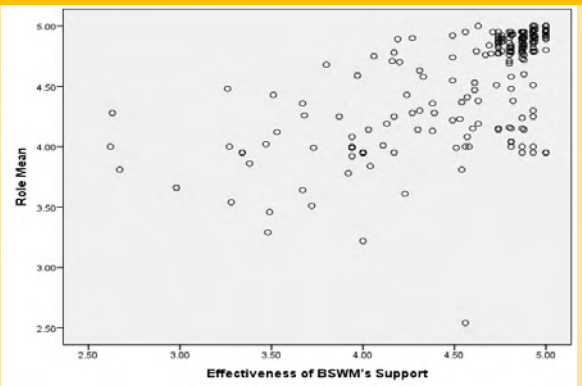


Relationship between Roles of Community Development Officers and Perceived Effectiveness of the BSWM's Institutional Support to Pilot SWISAs

Revealed further in the study that there is a highly significant and positive relationship (*p*-value=0.001; *r*=0.642) between the roles of CDOs and perceived effectiveness of BSWM's institutional support. The coefficient of 0.642 suggests a moderate correlation while the coefficient of determinants (r^2=0.413) implies that 41.3% of the variance in the perceived effectiveness of BSWM's institutional support can be explained by the level of CDOs understanding of their roles.

Figure 2

Scatter Plot for the Relationship Roles of CDOs and Perceived Effectiveness of BSWM's Institutional Support



Also, the finding shows that as the CDOs' level of understanding of their roles increases, the perception on the effectiveness of support also increases (Figure 2). Thus, the higher the performance

rating of CDOs in undertaking their roles to SWISAs the higher the perceived effectiveness of the extension support provided.

The result supported the findings of Sarker & Itohara (2009) in Bangladesh, wherein the credibility of extension workers in performing their roles had a significant relationship with the effectiveness of the extension services. In this regard, the highly significant relationship observed between the roles of CDOs and effectiveness of institutional support implies that SWISA farmer members are satisfied with the work of CDOs which yielded positive perception on the BSWM's program.

Conclusion

The result showed that there is a high level of participation among SWISA farmer members which is attributed to the benefits and advantages they gained from the associations' services and government interventions. The respondents highly rated the hired CDOs assigned in regions in undertaking their roles signifying that they are well capacitated in providing extension services to SWISAs. With the foregoing findings, the BSWM's institutional support yielded positive perception among SWISA farmers in Luzon and considered the extension program as highly effective.

Moreover, based on the results of this study, as the level of participation of SWISA members in the organizational undertakings, operation and maintenance activities, and implementation of activity plans increases, the perception of effectiveness of BSWM's institutional support to pilot SWISAs also increases. Revealed further in the study that as the level of understanding of CDOs of their roles in conducting organizational and monitoring activities, capacity enhancement, and coordinating activities increases, the perception on the effectiveness of the provided extension support also increases.

Recommendations

It is evident the result of the study that the role of contracted CDOs in the regions is significant in the attainment of BSWM's goal on institutional supports to SWISAs, hence, it is recommended that the BSWM may continue to strengthen CDOs to further facilitate the programs extended to SWISAs. Moreover, to ensure the continuity of the extension program and services of experienced and capacitated extension staff towards the sustainability of irrigation infrastructures, SSIP implementers (i.e., BSWM, DA-RFOs, and LGUs) may provide security of tenure for CDOs.

With the perceived effectiveness of the institutional support, the DA and BSWM may conduct surveys, focused group discussions, and interviews to SSIP farmer beneficiaries to generate actual needs in the continuation of activities and allocate funds for the expansion of the program. Noting the effectiveness of BSWM's extension support in Luzon, further studies may be made in other regions of the country to determine how SWISA farmers in the Visayas and Mindanao perceived the effectiveness of the institutional development program.

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Exogenous Application of Paclobutrazol and Potassium Nitrate in Growth and Survival of Waterlogged Tomato

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Abstract

The general objective of this study was to evaluate the effects of exogenous application of PBZ and KNO_3 in tomato subjected to different water regime. Specifically, it aimed to determine the response of tomato under different water regime as affected by application of PBZ and KNO_3, and identify the optimum concentration of the two PGRs that will give highest survival of tomato in different water regime. Waterlogging caused reduction in %survival of tomato; however no further decreased from 24hrs to 48hrs waterlogging. This trend was similar to plant height, number of leaves, leaf dry weight, stem dry weight, plant dry weight, and days to flowering. In terms of PGRs, across WR, no significant effect was observed in chlorophyll content, stem dry weight, and root dry weight. Application of PBZ at any concentration caused reduction in plant height while increased leaf dry weight and plant dry weight was observed at 250 ppm. However, PBZ at 500 ppm decreased leaf dry weight. Increased plant dry weight and earlier days to flower was achieved by KNO_3 application. Combined application of 500 ppm PBZ and 8% KNO_3 decreased the survival rate and the number of adventitious roots and caused delay in initiation of adventitious roots and induction of flower. Exogenous application of PGRs at lower concentrations (4% KNO_3 + 500 ppm PBZ) showed positive results in the growth and survival of waterlogged tomato plants however, further study focused in timing of application and combination with other PGRs is also recommended.

Keywords: *waterlogging tolerance, flooding, hypoxia, paclobutrazol*

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Introduction

Climate change may be due to natural cycles such as solar cycles, volcanic eruptions, and persistent anthropogenic changes in composition of the atmosphere and/or in land use (IPCC, 2012). One of the alterations under climate change is increasing global maximum temperature. Increase in temperature disturbs the hydrologic system. Higher temperature increases the rate of evaporation making some dry areas extremely dry while some wet areas extremely wet or change in rainfall pattern. The increasing rate of evaporation will increase the frequency of more intense rainfall resulting to more frequent occurrence of flood. Floods become more prominent around the world since 1950s. It results to loss of life, damaged to properties, deterioration of health conditions due to waterborne diseases, and impact in agriculture particularly in crop production. According to United Nations (2015), climate-related disasters are causing 14% damage and loss in agricultural sector of developing countries, including the Philippines.

The Philippines as a tropical country is one of the most typhoon-prone countries in the world experiencing at least six months of rain from 11 to 25 typhoons per year. In 2016, a super typhoons Lawin (international name “Haima”) and Karen (international name: “Sarika”) caused Php 10.21 B damage in agriculture mostly in crop sub-sector (99.51% or Php 10.16 B). According to PhilStar Global (2016), value of damage incurred to vegetables is at P 1.7 B wherein 60% of this damage is due to flooding (United Nations, 2015). In addition to that, 18,928 MT of vegetable produce were lost and 33,501 hectares of cultivation area were affected.

In many areas, farmers are likely to plant vegetables in the late part of third quarter or early part of fourth quarter of the year because of decreasing amount of rainfall and higher price of produced. However, typhoons occuring in this part of the year are causing more damage not just because of its strength but also larger area are planted with crops, especially vegetables which are more susceptible to flooded or waterlogged conditions.

Waterlogged condition creates hypoxic (low O_2) and anoxic (abscence of O_2) conditions as it slows down the diffusion of O_2 causing imbalance on physiological processes in plant particularly respiration. The results are decreased in root activities like water and nutrient absorption, damage to cells due to reactive oxygen species (ROS) and consequently significant yield reduction (Ashraf, 2012). However, some plants have developed several adaptive mechanisms which include the development of adventitous roots (Islam et al., 2010), formation of aerenchyma (Jackson, 2008), presence of hypertrophied lenticels and lastly, ability to produce antioxidants to detoxify ROS (Lambers et al., 2008).

Plant adaptation to stress can be enhanced through breeding and application of chemicals or plant growth regulators (PGRs). Application of chemicals or PGRs is inevitable in crop production. It can be used to hasten development of mitigation and adaptation measures to maintain or even increase productivity of different crops in the face of climate change. There are reported chemicals such as paclobutrazol (PBZ) and potassium nitrate (KNO_3) that can individually alleviate to some extent the effects of waterlogging to plants. Paclobutrazol was able to protect the plants from waterlogging stress due to increased levels of antioxidant activity which combats the negative effects of ROS (Lin et al., 2008). In KNO_3, potassium improves photosynthetic rate and nutrient uptake hence, higher plant growth rate (De Carvalho, 2015). On other hand, NO_3^- which is reduced to NO_2^- has been observed to increase

the survival of plant by playing a role as an alternative electron acceptor, improving ATP synthesis and preventing cell super reduction under hypoxic condition (Stoimenova et al., 2007).

The increasing frequency of waterlogging occurrence due to climate change will cause more damage and losses in crop productivity particularly in vegetables which are highly susceptible to waterlogged stress. Among vegetable crops, tomato is widely used as experimental plant in waterlogging studies. A lot of studies have been done to maintain crop productivity or minimize losses under waterlogged condition. These include improving waterlogging tolerance through breeding, cultural practices, and application of chemicals or plant growth regulators. Improvement of waterlogging tolerance through chemical application is faster than breeding and not crop specific, meaning can be applied to other crops; and might be more productive and profitable than cultural practices. Based on recent studies, PBZ and KNO_3 have the potential of enhancing the survival and productivity of crops under waterlogged stress. However, these chemicals are not yet tested in combination in any crops under stress particularly waterlogged stress; hence, will be evaluated in this study. This study aims to investigate waterlogging tolerance of tomato using PBZ and KNO_3 and examine plant growth response. Improved waterlogging tolerance will increase crop production by maintaining crop productivity under waterlogged stress and widening the area for cultivation. Studying plant adjustment under waterlog stress will contribute to advancement of science in this field and may open door to further elevate crop productivity under such condition.

Materials and Methods

Cultural Management of Tomato

Rosanna is the variety of tomato used in the study. It is an off-season, open-pollinated variety with moderate plant vigor and prolificacy, medium maturity and flowers 27-30 days after transplanting. Rosanna has small to medium (30-60 g/fruit) high round fruits, moderately firm, and turns red orange when ripe. This variety is a heat tolerant all-season tomato with wide adaptation. The seeds were acquired from Nueva Ecija Fruit and Vegetable Seed Center (NEFVSC) in Science City of Muñoz, Nueva Ecija.

Since the study is pot experiment, black polyethylene garden bags were used. The garden bags have four drainage holes at the bottom. The polyethylene bags with size of 25 x 15 cm (diameter x height) were planted with 5 plants per pot.

Seeds were sown in a seedling tray with 2:1 river sand and organic fertilizer. Carbaryl was applied immediately against ant attack. The seedling trays were placed under shed and transferred to greenhouse made of net 5 days after sowing (DAS) when the tomato seedlings produce true leaves.

At 10 DAS, a starter solution (1tbsp of urea gal^{-1}) was applied to seedlings. Seedlings were thinned at 12 DAS. At 14 DAS, seedlings were transferred from greenhouse to full sunlight for hardening. Seedlings were watered every other day.

At 23 DAS, five seedlings were transplanted to each polyethylene bags and placed in an open area. A mixture of 5 g of 46-0-0 and 5 g of 0-0-60 is applied per pot at 49 DAS.

Plants were protected from pests and diseases during the entire period of experiment. At seedling stage of tomato, insecticide (Cartap Hydrochloride) was sprayed against leaf miner attack. It was followed by the application of fungicide (Copper Hydroxide) at 3 days after transplanting (DAT) then after waterlogging treatment. On the other hand, in terms of weed management, spot weeding was done during the entire period of experiment.

Treatments, Experimental Design and Statistical Analysis

In this study, there were two factors: water regime and combination of PBZ and KNO_3. Treatments were arranged using Split-plot in RCBD with 3 replications per treatment. Water regime or WR (0, 24, and 48 h) was assigned as main plot while combination of KNO_3 (0, 4, 8%) and PBZ (0, 250, 500 ppm) were assigned as sub plot.

At 28–35 DAS, plants were subjected to different water regime with a depth of 3-5 cm above the soil surface. Water level was maintained throughout the treatment by monitoring the water level twice a day (06:00 and 18:00 h).

Two (2) days prior to waterlogging treatment, PGRs were applied separately by foliar application, PBZ (9:00-12:00) then KNO (13:00-17:00). Card-boards were used as a barrier to facilitate separate application of PGRs as well as to avoid contamination with other treatments.

For better control of treatment application such as timing of occurrence, duration, and severity of waterlogged treatments, this study was set-up using pot experiment in an open area. In addition, it facilitated easier collection and better evaluation of samples, and easier management of large number of treatments. The data were analyzed using analysis of variance (ANOVA) to test the significance of the results and the least significant difference (LSD) for comparison of treatments with 5% level of significance.

Results and Discussions

Percent Survival (%)

The result for percent survival of tomato at 14 DAWI is presented in Table 1. Analysis of variance showed significant differences in water regimes (WR) as well as in combined concentrations of PBZ and KNO_3 (PK) but not significant in WR:PK interaction.

In terms of water regimes, regardless of duration, waterlogging caused significant reduction in survival of tomato plants; however, there was no significant reduction from 24-hr to 48-hr with 24.59% and 16.15%, respectively. According to Apal and Hirt (2004) and Ashraf (2009), the decreased survival of plant under flooded condition is linked in increased ROS which are injurious to cellular membranes and other cellular components when the concentrations reached the point of phytotoxicity, rapidly inactivating the enzymes, damaging vital cellular organelles in plants and destroying membranes by inducing the degradation of pigments, proteins, lipids and nucleic acids which eventually results to cell death (Karuppanapandian et al.,2011).

Table 1

Percent (%) Survival of Tomato at 14 DAWI

TREATMENT	WATER REGIME			
	Non-waterlogged	24hrs waterlogged	48hrs waterlogged	MEAN[b]
0% KNO3 + 0 ppm PBZ	70.67	44.00	20.00	**44.89a**
0% KNO3 + 250 ppm PBZ	62.67	38.67	17.33	**39.56ab**
0% KNO3 + 500 ppm PBZ	73.33	42.67	22.67	**46.22a**
4% KNO3 + 0 ppm PBZ	65.33	20.00	16.00	**33.78abc**
4% KNO3 + 250 ppm PBZ	70.67	16.00	18.67	**35.11abc**
4% KNO3 + 500 ppm PBZ	58.67	12.00	13.33	**28.00bc**
8% KNO3 + 0 ppm PBZ	45.33	24.00	12.00	**27.11bc**
8% KNO3 + 250 ppm PBZ	54.66	10.67	14.67	**26.67bc**
8% KNO3 +500 ppm PBZ	46.67	13.33	10.67	**23.56c**
MEAN[a]	**60.89a**	**24.59b**	**16.15b**	

[a,b] Means with the same letters are not significantly different at 0.05 HSD level.

Within concentration of PGRs, highest percent survival was found in highest concentration of PBZ without KNO_3 application (0%KNO3 + 500 ppm PBZ) with 46.22% but was comparable to any PBZ concentration without KNO_3; and at 0 and 250 ppm PBZ at 4% KNO_3. However, at increasing KNO_3 concentration, it seems that highest PBZ concentration had negative effect in percent survival of tomato plants. Furthermore, there was a decreasing trend in percent survival at increasing KNO_3 concentration indicating the negative effect of high level of KNO_3 on survival of tomato at vegetative phase. This result contradicts the study of Hadad et al. (2016) which concludes that exogenous application of K could ameliorate the negative effects of waterlogging.

Several authors had supported the finding of the study. Studies conducted by Yiu et al. (2008) in Welsch onion and Lin et al. (2008) in sweet potato, under waterlogged condition, PBZ application significantly enhanced the antioxidant system increasing the radical scavenging activity against ROS which enhances the tolerance of plants under flooded condition.

Chlorophyll Content

The result on the number of chlorophyll content of tomato at 14 DAWI was presented in Table 2. Analysis of variance showed that there was significant difference at WR only. Highest chlorophyll content was found under non-waterlogged condition, however, comparable under 48-hr waterlogged condition.

The reduced chlorophyll content observed in 24-hr is consistent with the studies of Ashraf et al. (2011) and Zeng et al. (2020) which stated that one of the first responses of plant under waterlogging is sudden reduction in the leaf chlorophyll content then chlorosis as induced by N deficiency (Jaiswal and Srivastava, 2015; Fletcher and Arnold, 1986). Waterlogging stress reduced the production of lipid peroxidation and ethylene production in the leaves as demonstrated by Habibzadeh et al. (2013). Furthermore, reduced chlorophyll content and damage to cells and membrane system declined the ability of the leaves to photosynthesize (Sharma et al., 2022).

Table 2

Chlorophyll Content of Tomato Leaves at 14 DAWI

TREATMENT	WATER REGIME			MEAN[b]
	0-hr	24-hr	48-hr	
0% KNO3 + 0 ppm PBZ	57.67	54.90	56.22	**56.26**
0% KNO3 + 250 ppm PBZ	65.01	53.62	50.55	**56.39**
0% KNO3 + 500 ppm PBZ	65.60	51.14	56.19	**57.64**
4% KNO3 + 0 ppm PBZ	59.91	63.83	64.57	**62.77**
4% KNO3 + 250 ppm PBZ	65.86	46.35	64.45	**57.89**
4% KNO3 + 500 ppm PBZ	67.62	49.65	55.13	**57.47**
8% KNO3 + 0 ppm PBZ	67.89	61.89	67.47	**65.75**
8% KNO3 + 250 ppm PBZ	69.77	52.89	64.76	**62.47**
8% KNO3 +500 ppm PBZ	71.67	70.43	54.93	**65.68**
MEAN[a]	**65.67a**	**56.08b**	**59.36ab**	

[a]Means with the same letters are not significantly different at 0.05 HSD level.

Plant Height (cm)

The results for the growth of tomato 14 DAWI were presented in Table 3. Analysis of variance at 14 DAWI had both significant effects in terms of WR and combined concentration of PGRs but had no significant effect at interaction level.

Table 3

Plant Height (cm) of Tomato Plant at 14 DAWI

TREATMENT	WATER REGIME			MEAN[b]
	0-hr	24-hr	48-hr	
0% KNO3 + 0 ppm PBZ	45.75	31.68	33.25	**36.89a**
0% KNO3 + 250 ppm PBZ	33.88	25.14	26.66	**28.56c**
0% KNO3 + 500 ppm PBZ	35.63	22.44	25.97	**28.02c**
4% KNO3 + 0 ppm PBZ	41.58	33.00	30.17	**34.92ab**
4% KNO3 + 250 ppm PBZ	39.92	26.17	27.01	**31.03bc**
4% KNO3 + 500 ppm PBZ	34.02	24.11	27.50	**28.54c**
8% KNO3 + 0 ppm PBZ	40.97	30.72	30.75	**34.15ab**
8% KNO3 + 250 ppm PBZ	37.10	26.08	26.44	**29.88bc**
8% KNO3 +500 ppm PBZ	32.23	27.78	23.29	**27.77c**
MEAN[a]	**37.90a**	**27.90b**	**27.89b**	

[a,b]Means with the same letters are not significantly different at 0.05 HSD level.

In terms of WR, there was higher difference (10 cm) between non-waterlogged and waterlogged treatments but again, 24-hr and 48-hr had similar plant height. Hence, waterlogging can cause significant reduction in height of tomato plants; however, prolonging the waterlogging duration from 24-hr to 48-hr had no further reduction in height. With regards to PGRs, there was a reduction in plant height caused by PBZ in almost all levels of KNO_3 and no significant reduction from 250 to 500 ppm PBZ. According to Fletcher and Holsta (1985), they stated that the reason for the decreased plant height by exogenous application of PBZ is that triazoles (e.g. PBZ) can affect the isoprenoid pathway, altering the levels of

certain plant hormones such as inhibition of gibberellin synthesis. Also, KNO_3 cannot reverse the negative effect of PBZ in plant height, as it contradicts the study conducted by Ashraf *et al.* (2011) who stated that exogenous application of K^+ increased the growth of cotton plants (*Gossypium hirsutum* L.) under waterlogged condition.

Leaf Dry Weight per Plant (g)

The results for the leaf dry weight of tomato at 14 DAWI were shown at Table 4 which showed that significant differences were shown in all factors. Highest leaf dry weight of 3.78 g was found in non-waterlogged condition but with the help of 250 ppm PBZ without KNO_3 application. Similar result was observed at the same condition in 250 ppm PBZ with 4% KNO_3.

However, under waterlogged condition, it seems that higher concentration of PBZ (500 ppm) had negative effect in leaf dry weight of tomato. In general, application of 250 ppm PBZ can increase leaf dry weight of tomato but increasing the rate further eventually decreased leaf dry weight.

Table 4

Leaf Dry Weight of Tomato at 14 DAWI

TREATMENT	WATER REGIME			MEAN[b]
	0-hr	24-hr	48-hr	
0% KNO3 + 0 ppm PBZ	1.85defghi	1.33efghijk	0.73ijk	**1.30**
0% KNO3 + 250 ppm PBZ	3.78a	1.53defghij	1.20fghijk	**2.17**
0% KNO3 + 500 ppm PBZ	1.88defgh	0.73ijk	0.78hijk	**1.13**
4% KNO3 + 0 ppm PBZ	2.54bcd	1.47defghijk	1.20fghijk	**1.74**
4% KNO3 + 250 ppm PBZ	3.52ab	2.30cdef	1.15ghijk	**2.32**
4% KNO3 + 500 ppm PBZ	2.22cdefg	0.80hijk	0.53jk	**1.18**
8% KNO3 + 0 ppm PBZ	2.40bcde	1.13ghijk	3.10abc	**2.21**
8% KNO3 + 250 ppm PBZ	1.65defghij	1.53defghij	1.35efghijk	**1.51**
8% KNO3 +500 ppm PBZ	2.24cdefg	0.40k	0.40k	**1.01**
MEAN[a]	**2.45**	**1.25**	**1.16**	

Means with the same letters are not significantly different at 0.05 HSD level.

This finding is consistent with the study conducted by Yiu et al. (2008) in waterlogged Welsch onion wherein lower amount of PBZ increased leaf dry weight of onion but there was no further increased at higher rate. The increased leaf dry weight can be attributed to wider and thicker leaves with more cuticular wax as mostly observed in PBZ-treated plants (Sopher, 1998) and increased cell depth and diameter and/or increased thickness of palisade and spongy mesophyll cells (Burrows et al., 1992).

Stem Dry Weight per Plant (g)

The results for the stem dry weight of tomato at 14 DAWI were presented in Table 5. In terms of WR, significant reduction in stem dry weight was observed among waterlogged plants however no further reduction from 24-hr to 48-hr waterlogging. Similar to the study conducted by Tareq et al. (2020) and Grichko and Glick (2001), significant reduction of stem diameter was also obtained when tomato plants was subjected to different waterlogging durations. This can be attributed to reduction in the rate of

photosynthesis, a physiological process responsible for production of sugar needed for the growth and development of plants.

Table 5

Stem Dry Weight of Tomato Plants at 0 and 14 DAWI

TREATMENT	WATER REGIME			MEAN[b]
	0-hr	24-hr	48-hr	
0% KNO3 + 0 ppm PBZ	1.15	0.80	0.30	**0.75**
0% KNO3 + 250 ppm PBZ	1.32	0.63	0.60	**0.85**
0% KNO3 + 500 ppm PBZ	0.84	0.40	0.37	**0.54**
4% KNO3 + 0 ppm PBZ	1.18	0.63	0.70	**0.83**
4% KNO3 + 250 ppm PBZ	1.43	0.70	0.50	**0.88**
4% KNO3 + 500 ppm PBZ	1.23	0.40	0.30	**0.64**
8% KNO3 + 0 ppm PBZ	1.12	0.57	1.00	**0.89**
8% KNO3 + 250 ppm PBZ	0.74	0.57	0.60	**0.64**
8% KNO3 +500 ppm PBZ	1.13	0.30	0.30	**0.57**
MEAN[a]	**1.13a**	**0.56b**	**0.52b**	

[a]Means with the same letters are not significantly different at 0.05 HSD level.

In this study, PGRs had no effect in stem dry weight of tomato. However, based on other studies, PBZ and KNO_3 can increase stem dry weight of plants. In the study of Tsegaw et al. (2005), application of PBZ increased stem dry weight of potato. On the other hand, Ashraf et al. (2011) found that exogenous application of K increased stem dry weight of cotton by 41.1% under waterlogged condition.

Root Dry Weight per Plant (g)

The results on the root dry weight of tomato at 14 DAWI were presented in Table 6 where significant difference at WR level only were shown. Similar to stem dry weight, highest root dry weight was obtained from non-waterlogged plants and was comparable to plants subjected for 24-hr and 48-hr waterlogging.

Moreover, no significant reduction was observed between the two WR. With regards to chemical application, no significant difference was shown among PGRs. Significant reduction of root dry weight of waterlogged plants can be attributed to reduced root size due to impede growth and damage and decay of the existing root system (Herzog et al., 2015). Further, study done by Habibzadeh et al. (2013) elucidated that flooding significantly decreased root dry weight as a result of oxidative stress induce by waterlogged condition.

Table 6

Root Dry Weight of Tomato Plant at 0 and 14 DAWI

TREATMENT	WATER REGIME			MEAN[b]
	0-hr	24-hr	48-hr	
0% KNO3 + 0 ppm PBZ	0.60	0.27	0.20	**0.36**
0% KNO3 + 250 ppm PBZ	0.70	0.20	0.30	**0.40**
0% KNO3 + 500 ppm PBZ	0.42	0.20	0.20	**0.27**
4% KNO3 + 0 ppm PBZ	0.50	0.27	0.30	**0.36**
4% KNO3 + 250 ppm PBZ	0.66	0.40	0.25	**0.44**
4% KNO3 + 500 ppm PBZ	0.64	0.30	0.20	**0.38**
8% KNO3 + 0 ppm PBZ	0.51	0.23	0.30	**0.35**
8% KNO3 + 250 ppm PBZ	0.29	0.30	0.20	**0.26**
8% KNO3 +500 ppm PBZ	0.50	0.20	0.20	**0.30**
MEAN[a]	**0.54a**	**0.26b**	**0.24b**	

[a]Means with the same letters are not significantly different at 0.05 HSD level.

Plant Dry Weight of Tomato (g)

The results on the plant dry weight of tomato at 14 DAWI were presented in Table 7. Analysis of variance showed significant differences in all factors, including WR:PK interaction. Regardless of water regimes, highest plant dry weight was found in treatments subjected to non-waterlogged condition (4.20 g) compared to treatments subjected to 24-hr and 48-hr waterlogging with 2.07 g and 1.92 g, respectively. However, there was no significant reduction observed between 24-hr and 48-hr waterlogging. The reduction in plant dry weight of waterlogged tomato can be attributed to decreased in the overall growth of plants.

Table 7

Plant Dry Weight (g) of Tomato at 0 and 14 DAWI

TREATMENT	WATER REGIME			MEAN[b]
	0-hr	24-hr	48-hr	
0% KNO3 + 0 ppm PBZ	3.61cdefg	2.40efghij	1.23ij	**2.41**
0% KNO3 + 250 ppm PBZ	5.80a	2.37efghij	2.10ghij	**3.42**
0% KNO3 + 500 ppm PBZ	3.14cdefgh	1.33ij	1.33ij	**1.93**
4% KNO3 + 0 ppm PBZ	4.22abcd	2.37efghij	2.20fghij	**2.93**
4% KNO3 + 250 ppm PBZ	5.61ab	3.40cdefg	1.90ghij	**3.64**
4% KNO3 + 500 ppm PBZ	4.85abc	1.50hij	1.03ij	**2.46**
8% KNO3 + 0 ppm PBZ	4.03bcde	1.93ghij	4.40abcd	**3.45**
8% KNO3 + 250 ppm PBZ	2.69defghi	2.40efghij	2.15fghij	**2.41**
8% KNO3 +500 ppm PBZ	3.88bcdef	0.90j	0.90j	**2.41**
MEAN[a]	**4.20**	**2.07**	**1.92**	

Means with the same letters are not significantly different at 0.05 HSD level.

In terms of PGRs, highest dry weight of 5.80 g was acquired with application of 250 ppm PBZ without KNO_3 under non-waterlogged condition, which was comparable to 0, 250, 500 ppm PBZ with 4% KNO_3 under the same condition. Under 24-hr, highest plant dry weight was observed in 4% KNO_3 + 250 ppm PBZ but comparable to almost all PGR treatments except to those with 500 ppm PBZ indicating the

negative effect of high concentration of PBZ (500 ppm) to plant dry weight of tomato subjected to 24-hr waterlogged condition. Furthermore, this negative effect of high concentration of PBZ cannot reverse by application of KNO_3. At 48-hr waterlogged condition, almost all treatments had comparable plant dry weight.

Increased plant dry weight by application of PBZ at 250 ppm can be due to increased chlorophyll levels, enlarged chloroplasts, thicker leaf tissue, increased root to shoot ratio and elevated levels of epicuticular wax formation (Watson and Himelick, 2004) morphological changes brought by PBZ. The negative effect of high concentration of PBZ in plant dry weight of tomato subjected to waterlogged condition (24-hr) as found in this study, contradicts the result of El Said et al. (2017) where in waterlogged servia plants, dry weight gradually increased at increased concentration of PBZ.

Days to First Initiation of Adventitious Roots

The result for the days to first initiation of adventitious roots was presented in Table 8. Analysis of variance showed that there were significant differences in combined concentrations of chemicals (PK) and WR:PK interaction. Based on the result, there was no clear trend except that plants treated with high concentration of KNO_3 and PBZ in combination (8%KNO_3 + 500ppm PBZ) caused delay in initiation of adventitious roots in different water regimes.

According to Malik et al. (2001), the formation of adventitious roots potentially replacing the basal roots is considered as one of the potential morphological adaptations depicted by plants under waterlogged condition. However, rapid initiation of adventitious root is not only limited in flooded condition but also in non-flooded condition as observed in this study. Based on the result, initiation of adventitious roots under non-flooded condition was triggered by the application of 0 and 250 ppm PBZ under 4% KNO_3; 0 ppm PBZ with 8% KNO_3. According to Yu et al. (2001), growth of adventitious roots of ginseng was increased as higher nitrate (NO_3^-) concentration (2 mg L^{-1}). PBZ promoted adventitious root formation in olive cuttings (Salari et al., 2017) where PBZ treated cuttings had a higher cutting viability, rooting percentage, number of roots per cutting, root length and root fresh and dry weights than control.

Table 8

Days to 1st Initiation of Adventitious Roots

TREATMENT	WATER REGIME			MEAN[b]
	0-hr	24-hr	48-hr	
0% KNO3 + 0 ppm PBZ	4.27def	3.00i	3.87efgh	**3.71**
0% KNO3 + 250 ppm PBZ	4.20def	4.27def	4.13def	**4.20**
0% KNO3 + 500 ppm PBZ	3.80efgh	4.07def	3.96defg	**3.94**
4% KNO3 + 0 ppm PBZ	3.27ghi	3.27ghi	4.38cdef	**3.64**
4% KNO3 + 250 ppm PBZ	3.13hi	4.33cdef	4.17def	**3.88**
4% KNO3 + 500 ppm PBZ	5.13ab	4.07def	3.80efgh	**4.33**
8% KNO3 + 0 ppm PBZ	3.67fghi	4.13def	3.60fghi	**3.80**
8% KNO3 + 250 ppm PBZ	4.67bcd	4.53bcde	4.07def	**4.42**
8% KNO3 +500 ppm PBZ	5.07abc	5.03abc	5.67a	**5.26**
MEAN[a]	**4.13**	**4.08**	**4.18**	

Means with the same letters are not significantly different at 0.05 HSD level.

Number of Adventitious Roots

The result on the number of adventitious roots was presented in Table 9. Analysis of variance showed significant differences within durations of waterlogging (WR) and combined concentration of chemicals (PK) but failed to have significant effect in WR:PK interaction.

Table 9

Number of Adventitious Roots at 7 days after Waterlogging Imposition (7 DAWI)

TREATMENT	WATER REGIME			MEAN[b]
	0-hr	24-hr	48-hr	
0% KNO3 + 0 ppm PBZ	2.13	2.93	2.47	**2.51a**
0% KNO3 + 250 ppm PBZ	1.80	2.07	2.37	**2.08abc**
0% KNO3 + 500 ppm PBZ	1.80	2.27	2.16	**2.07abc**
4% KNO3 + 0 ppm PBZ	2.47	2.27	1.70	**2.28ab**
4% KNO3 + 250 ppm PBZ	2.00	2.20	2.03	**2.08abc**
4% KNO3 + 500 ppm PBZ	1.47	2.13	1.44	**1.68cd**
8% KNO3 + 0 ppm PBZ	2.07	2.60	1.87	**2.18abc**
8% KNO3 + 250 ppm PBZ	1.67	1.80	1.64	**1.70bcd**
8% KNO3 +500 ppm PBZ	1.40	1.44	1.17	**1.34d**
MEAN[a]	**1.87b**	**2.23a**	**1.87b**	

[a,b]Means with the same letters are not significantly different at 0.05 HSD level.

In terms of water regimes, highest number of adventitious roots was found in 24-hr waterlogged period with an average of 2.23. With that, it seems that the number of adventitious roots has direct relationship with initiation as faster induction of root was found in the same duration (see Table 11). Plants exposed to 48-hr waterlogging had the lowest number of adventitious roots with 1.87 with similar result in non-waterlogged condition.

In terms of PGRs, highest number of roots was attained in control but comparable to almost all treatments except to treated with 4%KNO_3 + 500ppm PBZ and to 250 and 500 ppm PBZ under 8% KNO_3. Based on the result, application of higher concentration of PBZ (combined to either 4% and 8% KNO_3) caused negative effect by reducing the number of adventitious roots of tomato under waterlogged condition.

Days to First Flowering (DAS)

Table 10 presented the result of the days to first flowering of tomato. Analysis of variance showed that different durations of waterlogging (WR) and combined concentration of chemicals (PK) influence the days to first flowering of tomato but no significant effect in WR: PK interaction.

Table 10

Days to Flowering of Tomato (DAS)

TREATMENT	WATER REGIME			MEAN[b]
	0-hr	24-hr	48-hr	
0% KNO3 + 0 ppm PBZ	52.23	60.45	59.28	**57.32ab**
0% KNO3 + 250 ppm PBZ	54.27	60.43	58.24	**57.65a**
0% KNO3 + 500 ppm PBZ	51.17	61.10	59.64	**57.30ab**
4% KNO3 + 0 ppm PBZ	48.20	57.78	57.50	**54.49c**
4% KNO3 + 250 ppm PBZ	50.23	59.00	59.83	**56.36abc**
4% KNO3 + 500 ppm PBZ	49.13	57.60	59.44	**55.39abc**
8% KNO3 + 0 ppm PBZ	50.63	57.11	57.00	**54.92bc**
8% KNO3 + 250 ppm PBZ	51.35	58.00	58.83	**56.06abc**
8% KNO3 +500 ppm PBZ	52.60	61.50	59.84	**57.98a**
MEAN[a]	**51.09b**	**59.22a**	**58.85a**	

[a,b]Means with the same letters are not significantly different at 0.05 HSD level.

In terms of water regime, earliest flowering of tomato was seen under non-waterlogged condition with an average of 51 days whereas 24-hr and 48-hr took longer days to flower with both 59 DAS. The result was consistent from the study of Tareq et al. (2020) wherein earliest days to flower was obtained from non-waterlogged plants while prolonged waterlogging caused further delay in flowering of tomato.

In PGRs, treatments with 4% KNO3 without PBZ application results in earlier days of flowering with an average of 55 DAS which was comparable to treatments with KNO_3 except to 8% KNO3 with 500 ppm PBZ. However, treatments applied without KNO_3 showed late floral induction. Based on the result, earlier flowering can be attributed to the application of KNO_3 either separate or combine application but in lower concentration of PBZ (250 ppm).

According to the study of Nagao and Nishina (1993) in mango, nearly 16% of the terminals treated with 4% KNO_3 flowered by six weeks after but it was still determined by the condition of the terminal buds or the environmental conditions at the time KNO_3 was applied; however, the mode of action for KNO_3 during flower initiation is not fully understood. In terms of PBZ, study conducted by Mc Daniel (1983), stated that PBZ have not influenced flower initiation in herbaceous species.

Conclusion and Recommendation

Waterlogging caused significant reduction in growth and survival of tomato however, prolonged waterlogging duration have no significant effect. Exogenous application of PBZ and $CaNO_3$, at lower concentrations, have an ability to alleviate waterlogging stress while higher concentrations of the two chemicals can intensify the negative effects of waterlogging. Further study in the timing of application and combination of PBZ and $CaNO_3$ with other chemicals is recommended to improve waterlogging tolerance of tomato against waterlogging stress.

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Assessing Household's Awareness, Attitude and Practices for Effective Implementation of Modified Waste Segregation Scheme in Selected Barangays of Baliwag, Bulacan

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Abstract

The study aimed to assess the effectiveness on the implementation of modified waste segregation scheme in the pilot barangays of Baliwag, Bulacan such as Barangay Tangos, Pinagbarilan and Virgen delas Flores. Quantitative descriptive and correlational research designs were used in the study. The respondents were selected among the barangays with initial implementation of modified waste segregation scheme for at least two years. Based on the results of this study, the level of awareness, attitude and practices of the respondents and significantly affect the effectiveness on the implementation of the modified scheme for waste segregation. As the level of awareness, attitude and practices of household respondent's increases, the perception on the effectiveness on the implementation of modified waste segregation also increases. Likewise, the more information drives and environmental activities conducted by the educators, the higher the level of awareness for effective implementation of modified waste segregation scheme are perceived by the respondents. Results also revealed that there was a significant difference and improvement of SWM practices of the waste segregation before and after implementation of the modified waste segregation scheme. This research has demonstrated that solid waste management awareness, attitude, and practices of households are closely linked, which suggests that one strategic approach to implement successfully a solid waste management program is education, adoption and good governance.

Keywords: *awareness, attitude, practices, solid waste management, waste segregation, household, socio-demographic profile, random sampling*

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Introduction

As the population of the Philippines increases, the generation of solid wastes also becomes higher as standard of living is enriched and advancement in urban areas are being established. Solid waste refers to all discarded household, commercial waste, non-hazardous institutional and industrial waste, street sweepings, construction debris, agricultural waste, and other non-hazardous/non-toxic waste (RA No. 9003). The disposal and management of solid wastes is a major dilemma in both urban and rural areas.

According to a report by the Senate Economic Planning Office (SEPO), the country's waste generation steadily increased from 37,427.46 tons per day in 2012 to 40,087.45 tons in 2016. Meanwhile, solid wastes produced by Philippine cities are expected to increase by 165 percent to 77,776 tons by 2025.

Due to this alarming volume of generated solid wastes in the country, the condition of the Philippine environment has reached critical proportions in relation to solid waste management especially the efficient implementation of waste segregation (Azuelo, Barbado & Reyes, 2016).

According to the Housing and Urban Affairs Ministry Swachh Survekshan 2018 results, the argument that segregation is the key for waste management was only strengthened recently with the result that segregation at source is the heart of the waste management solution. It improves collection efficiency and leads to better efficiency in processing of waste and resource recovery.

Based on a Rappler's article published on September 14, 2018 at their website entitled "Why can't the Philippines solved their trash problem?", Greenpeace Philippines campaigner Abigail Aguilar mentioned that the Philippines has a good solid waste management law, but a lot more can be done in terms of implementation. Henceforth, the implementation of the programs of the Municipal Solid Waste management must be efficient, in fact practical, socially, lawfully worthy and ecologically amicable. Strong waste administration should be strictly implemented.

Baliwag is a first-class highly urban municipality in the province of Bulacan with a population of 153,762 inhabitants in 36,091 households and considered as the economic hub in the westernmost part of the province (2017). The municipality of Baliwag, Bulacan is an active local government unit which firmly value the prioritization for environmental protection. It can be observed through their different solid waste management practices namely: Palit-Basura/May Load sa Basura, Environmental Education Seminar, Weekly Clean up Drive and Baliwag Climate Change Center.

In the initial study conducted by the Municipal Environment and Natural Resources Office (MENRO), it was shown that an average of eighty-five (85) tons of solid wastes are generated daily (10-Year SWMP). As part of the said plan, this solid waste generation of the locality will be lessened as long as the effective implementation of waste segregation at source will be fully attained. As of now, the current waste segregation is divided into two classifications: biodegradable and non-biodegradable.

In order to address this dilemma for waste segregation, the municipality of Baliwag have acquired various solid waste management strategies. However, volume of solid wastes yearly and effectivity of existing solid waste management practices should be likewise considered. This leads to the remodeling of the existing waste segregation practice into modified waste segregation scheme namely:

biodegradable, paper, residuals, plastic, glass, hazardous and others to meet the needs into a much comprehensive implementation of waste segregation in household levels which was initially implemented in three (3) pilot barangays on January 2021.

The objective of this study was to evaluate the implementation of modified waste segregation practices in the pilot barangays of Baliwag, Bulacan. The study specifically aimed to assess the awareness, attitudes, and before-and-after practices of household respondents during the implementation of the modified waste segregation scheme, as well as their perception of its effectiveness.

Materials and Methods

The researcher sought permission from the Municipality of Baliwag, Bulacan through the Municipal Environment and Natural Resources Office (MENRO) to conduct the study. A survey questionnaire was developed to gather the data needed. Face-to-face interview which covers socio-demographic profile, awareness, attitude, practices before and after implementation of modified waste segregation were collected from the respondents. A likert scale was used to measure the respondent's rating on various variables for effective implementation of modified waste segregation.

The content of the survey questionnaire was subjected to validation by a qualified statistician with expertise in survey design and statistical analysis. Prior to data collection, identified potential sources of bias and selected appropriate data analysis methods were identified to ensure the accuracy and generalizability of the study results. This rigorous process significantly improved the questionnaire's reliability and validity, ensuring that the gathered responses were of high quality and suitable for analysis. Additionally, the survey questionnaire was translated to Filipino for better understanding of the respondents.

Moreover, the respondents identified were selected from the pilot barangays of Baliwag, Bulacan wherein the implementation of modified segregation scheme was initially implemented namely: Barangay Pinagbarilan, Tangos and Virgen delas Flores. Using random sampling and Slovin's formula (n = N/(1+Ne2), a total of 362 household respondents were selected for the study.

The gathered data from the survey was collected, summarized, tabulated, and analyzed using a statistical analysis software: percentages, frequencies, and Pearson Product Moment Correlation Coefficient Test are interpreted to present significant response to the specific problems of the study. Coding of data was done to reduce lengthy responses to essential, categorized, quantified, and assigned numerical representations.

Results and Discussion

Socio-Demographic Profile of Household Respondents

The socio-demographic profile of the household respondents was investigated by the researcher in terms of age, sex, civil status and educational attainment. Table 1 below shows that the majority of the respondents were young adults (49.72%) and 241 (66.6%) of the household respondents were females dominating males. A research conducted by Van de Mortel (2008) found that female participants were more likely to respond in survey than males which is attributed by the fact that women are more receptive individuals and more likely to be home-bound, giving them more time to complete surveys.

Based on the respondents' educational attainment, majority of the respondents are high school graduates with a percentage of 46.7%. The least number of respondents which is 17 are respondents from elementary level garnering 4.7%. Several studies have shown that those with a higher level of education are more likely to participate in surveys because they are more likely to have developed strong analytical and critical thinking skills, which may make them more responsive and offer insightful responses (Curtin et al., 2000).

Table 1

Household Respondents Age, Sex and Educational Attainment

Category	Frequency	Percentage
Age		
Young adult (18-35)	180	49.72
Middle-age adults (36-55)	155	42.82
Older adults (56 and above)	27	7.46
Sex		
Male	121	33.4
Female	241	66.6
Educational Attainment		
Elementary Level	17	4.7
Elementary Graduate	22	6.1
High School Level	58	16.0
High School Graduate	169	46.7
College Level	62	17.1
College Graduate	34	9.4

Awareness of Respondents on Waste Segregation

Table 2 shows that the household respondents are strongly aware on waste segregation (mean=4.29; SD=0.67). In a study conducted by Kumar et al. (2016), it was indicated that the majority of the household's level of awareness on waste segregation was seen to increase through education and information campaigns.

It was clearly shown that the indicator for awareness such as "Waste segregation is a social responsibility by each citizen and not just by the government" got the highest mean of 4.53; SD=0.63 with a verbal description of strongly aware.

Table 2

Awareness of Household Respondents on Waste Segregation

Awareness on Waste Segregation	Mean	SD	Verbal Description
Mandates and provisions of the Ecological Solid Waste Management Act of 2000 (RA9003)	4.10	0.73	Very much aware
Meaning, purpose and importance of waste segregation	4.41	0.61	Strongly Aware
Existing classification of waste in my municipality: bio, non-bio and recyclable	4.31	0.66	Strongly Aware
Modified classification of waste in my municipality: bio, non-bio, glass, paper, plastic, residuals, hazardous waste	4.09	0.78	Very much aware
Waste segregation is a social responsibility by each citizen and not just by the government	4.53	0.64	Strongly Aware
Schedule of modified waste segregation scheme M/Th: Bio, T: Paper, W: Residuals, F: Plastic Sat: Glass Sun: Hazardous waste	4.15	0.69	Very much aware
Municipality's environmental programs such as clean-up drive and palit-basura store	4.25	0.62	Strongly Aware
There is an organized waste disposal program in my area which is Palit-Basura Store	4.20	0.72	Strongly Aware
Meaning of 3R (Reuse, reduce and recycle)	4.48	0.61	Strongly Aware
Solid waste violators are punishable by law under RA9003	4.35	0.68	Strongly Aware
GRAND MEAN	**4.29**	**0.67**	**Strongly Aware**

Legend: 4.20-5.00 (Strongly Aware); 3.41-4.19 (Very much aware); 2.61-3.40(Moderately Aware); 1.81-2.60(Slightly aware); 1.00-1.80 (Not aware)

On the other hand, the least mean for awareness of respondents on waste segregation falls for "Modified classification of waste in my municipality: bio, non-bio, paper, plastic, residual waste" with a weighted mean of 4.09; SD=0.78 and verbal description of very much aware.

The level of awareness displayed by the respondents shows a positive outcome for the continuous conduct of information drive by MENRO since 2016 at schools and barangay level to promote and strengthen the campaign for proper solid waste management.

Attitude of Respondents on Waste Segregation

Table 3 demonstrates the attitude of the respondents towards segregation wherein the results obtained a grand mean of 4.55; SD=0.69 with verbal description of strongly agree.

Attitude indicator which pointed out that "Through segregation, environmental risks and health related concerns due to waste pollution will be prevented" garnered the highest mean of 4.65; SD=0.612 with verbal description of strongly agree.

Table 3

Attitude of Household Respondents on Waste Segregation

Attitude on Waste Segregation	Mean	SD	Verbal Description
Waste segregation is beneficial in terms of avoiding the mixing of waste in my house and to promote recycling in my community	4.59	0.53	Strongly Agree
As a duty of a responsible citizen, my friends and family believe that segregation should be done	4.60	0.54	Strongly Agree
Waste segregation at source is not a hindrance since it is not that tiring and time-consuming for me	4.48	0.57	Strongly Agree
I am willing to support processing of bio-waste through composting	4.51	0.62	Strongly Agree
In order to support the campaign for solid waste management, we must practice waste segregation at source	4.59	0.57	Strongly Agree
There are earning opportunities when you segregate wastes thru recycling or selling it to junkshops	4.63	0.54	Strongly Agree
Sacks/ nylon bags for waste collection should be provided 'free' to people	4.50	0.61	Strongly Agree
In situations that payment is necessitated, I have the willingness to pay for waste collection services	4.37	0.73	Strongly Agree
There should be available public trash bins in our area	4.58	0.58	Strongly Agree
Through segregation, environmental risks and health related concerns due to waste pollution will be prevented.	4.65	0.61	Strongly Agree
GRAND MEAN	**4.55**	**0.69**	**Strongly Agree**

Legend: 4.20-5.00 (Strongly Agree); 3.41-4.19 (Agree);
2.61-3.40(Neutral); 1.81-2.60 (Slightly Disagree);
1.00-1.80 (Strongly Disagree

Likewise, a verbal description of strongly agree was obtained in indicator such as, "In situations that payment is necessitated, I have the willingness to pay for waste collection services" which resulted the lowest mean of 4.37; SD=0.731. Almost all of the indicators focusing on attitude of respondents on waste segregation obtained a verbal description of strongly agree.

On the other hand, the least mean for awareness of respondents on waste segregation falls for "Modified classification of waste in my municipality: bio, non-bio, paper, plastic, residual waste" with a weighted mean of 4.09; SD=0.78 and verbal description of very much aware.

The level of awareness displayed by the respondents shows a positive outcome for the continuous conduct of information drive by MENRO since 2016 at schools and barangay level to promote and strengthen the campaign for proper solid waste management. The results obtained in the study shows that the increase in household respondents' attitude towards waste segregation has significant effect in the perceived effectiveness of modified waste segregation among household respondents. A study by Davies et al. (2013) found that positive attitudes towards waste reduction, recycling, and the

environmental benefits of waste segregation were strong predictors of active participation and compliance with segregation guidelines. Individuals who held favorable attitudes were more likely to engage in proper waste sorting and disposal practices.

Household Practices on Waste Segregation Before and After Implementation of Modified Waste Segregation

Table 4 shows the household practices on waste segregation before and after implementation of the modified waste segregation scheme spearheaded by the MENRO of Baliwag. There was an evident difference in the household practices in terms of waste segregation before (mean=3.09; SD=0.98) with verbal interpretation of every once in a while' and after implementation of the program (mean=3.98; SD=0.81) with verbal interpretation of 'sometimes'

Table 4

Household Practices on Waste Segregation Before and After Implementation of Modified Waste Segregation

Practices on Waste Segregation	Before			After		
	Mean	SD	VD	Mean	SD	VD
I am practicing waste segregation in our households	3.22	0.97	Every once in a while	4.43	0.71	Always
I have allotted enough bins for waste segregation	3.19	0.98	Every once in a while	4.40	0.73	Always
I use biodegradable wastes from our kitchen as compost	3.00	0.97	Every once in a while	4.08	0.82	Sometimes
I used to burn my wastes in the backyard	2.85	0.98	Every once in a while	2.64	1.38	Every once in a while
I am selling recyclable wastes such as paper and glass to junkshops	3.50	0.92	Sometimes	4.23	0.77	Always
I am abiding with the assigned waste collection schedule	3.46	0.88	Every once in a while	4.33	0.71	Always
I am segregating hazardous waste like facemask and face shields in my normal wastes	2.97	1.10	Every once in a while	4.07	0.73	Sometimes
I do attend environmental information campaign in our barangay	2.82	1.01	Every once in a while	3.85	0.76	Sometimes
I have encourage my family and friends to practice waste segregation	2.94	0.97	Every once in a while	3.94	0.73	Sometimes
I am participating in the environmental activities of the locality (clean-up drive/ palit-basura program)	2.93	1.03	Every once in a while	3.78	0.79	Sometimes
GRAND MEAN	**3.09**	**0.98**	**Every once in a while**	**3.98**	**0.81**	**Sometimes**

Legend: 4.20-5.00 (Almost Always); 3.41-4.19 (Sometimes); 2.61-3.40 (Every once in while); 1.81-2.60 (Rarely); 1.00-1.80 (Never)

For the practices of waste segregation before the implementation of modified scheme, the practice such as “I am selling recyclable wastes such as paper and glass to junkshops” gained the highest mean result of 3.50; SD=0.92 with verbal description of every once in a while.

Additionally, before implementation practices such as “I do attend information education campaign in our barangay” obtained the lowest mean of 2.82; SD=1.01 with verbal description of sometimes. In terms of practices after the implementation of modified waste segregation, the practice such as “I am practicing waste segregation in our households” acquired a verbal description of always and a mean of 4.43; SD=0.71 which is considered the highest during the after implementation phase.

However, the practice such as “I used to burn my wastes in the backyard” with verbal description every once in a while obtained a weighted mean of 2.64; SD=1.38 which served as the least mean for practices in the after implementation phase of modified waste segregation.

The findings revealed that the increase in practices on waste segregation has significant effect in the perceived effectiveness of modified waste segregation among household respondents. Research by Tamin et al. (2017) revealed that households with well-established waste management routines, such as regular waste sorting and proper container labeling, demonstrated higher levels of adherence to waste segregation guidelines. These practices were found to facilitate the ease and convenience of segregation, making it more likely for households to participate consistently.

Difference of Practices Before and After Implementation of Modified Waste Segregation Scheme

Based on the result of paired sample T-test, Table 5 shows that there is significant difference on the practices of waste segregation before and after implementation of modified waste segregation scheme. Since the value of SD decreases in the after implementation phase, the acquired data became more consistent which implies that waste segregation practices of the household respondents adheres more in the modified waste segregation program. Also, because the mean increased in the after implementation of the modified household waste segregation, it means the number of households practicing waste segregation increased.

This confirms the study of Osaya (2019) which emphasized the need for continuous innovation, policy changes and improvements in waste segregation practices to achieve a cleaner and more sustainable environment.

Table 5

Difference of Practices Before and After Implementation of Modified Waste Segregation Scheme

Practices of Waste Segregation	Mean	SD	P-Value	Interpretation
Practices before implementation of waste segregation	3.09	0.77	0.000**	Highly significant
Practices after implementation of waste segregation	3.98	0.48		

**significant at 0.01 level of significance

Effectiveness of Modified Waste Segregation

In reference to Table 6 below, the researcher has determined that overall, the respondents *strongly agree* with the effectiveness of modified waste segregation scheme (mean=4.38; SD=0.63). The highest mean obtained for effectiveness of modified waste segregation is 4.38; SD=0.63 which falls for "I am aware of the earning (thru junkshops) and recycling opportunities brought by modified waste segregation with verbal description of *strongly agree.*

Since 2016 when the SWM of Baliwag Bulacan was implemented by MENRO, efforts have been made for the proper implementation of the program such as Environmental Awareness Seminar, Palit-Basura, Clean-up Drive, etc. The results of this study suggested that these efforts have not been wasted.

Table 6

Effectiveness of Modified Waste Segregation

Effectiveness of Modified Waste Segregation	Mean	SD	Verbal Description
Unlike the former segregation scheme, it is easier to perform segregation thru modified waste segregation scheme	4.44	0.672	Strongly Agree
The modified waste segregation scheme is effective to strengthen segregation at source	4.44	0.639	Strongly Agree
Modified waste segregation motivates me to be more engage and pro-active in different environmental activities such as Palit-basura Stores	4.35	0.642	Strongly Agree
I am compliant with the collection schedule of modified waste segregation compare to the old segregation scheme	4.37	0.606	Strongly Agree
I am more knowledgeable on proper waste management thru this modified waste segregation	4.36	0.618	Strongly Agree
Thru modified waste segregation, my family and friends are now practicing segregation unlike before implementation	4.28	0.613	Strongly Agree
Modified waste segregation brings positive impact to become a responsible citizen supporting solid waste management as well as protect the environment from waste pollution	4.35	0.620	Strongly Agree
The garbage truck for collection under modified collection is always on time	4.35	0.723	Strongly Agree
I am aware of the earning (thru junkshops) and recycling opportunities brought by modified waste segregation	4.48	0.577	Strongly Agree
Modified waste segregation is easier to follow compare to old segregation and should be fully implemented in our locality	4.36	0.631	Strongly Agree
GRAND MEAN	**4.38**	**0.63**	**Strongly Agree**

Legend: 4.20-5.00 (Strongly Agree); 3.41-4.19 (Agree); 2.61-3.40(Neutral); 1.81-2.60(Slightly Disagree); 1.00-1.80 (Strongly Disagree)

Prior study by Gani (2014) cited that segregation of solid waste at source is a panacea for effective management of solid waste. A high level of awareness and education on sanitation, environmental health matters and benefits of segregation at household level should be created to the entire public so that they can appreciate need for a clean living environment and actively participate in the segregation exercise.

Relationship between Sex and Effectiveness of implementation of the Modified Waste Segregation Scheme

Table 7 below shows that there is a high significant difference (*p*=0.036) in the perceived effectiveness of modified waste segregation between male (mean= 4.45) and female (mean=4.38).

The study of Solomon and Edet (2018) found out that males had higher probabilities of adopting environmental adaptation strategies than females. Hence, Ngigi et al. (2017) argued that the adoption of environmental adaptation strategies by gender is interplayed with responsibilities and social norms because women need to be consulted first when improvement schemes are planned so that their insights and status are highly valued & protected.

Table 7

Difference in Terms of Sex to Effectiveness of Implementation

Practices of Waste Segregation	Mean	SD	P-Value	Interpretation
Male	4.45	0.38	0.036**	Highly significant
Female	4.38	0.45		

**significant at 0.01 level of significance

Relationship between Household Awareness, Attitude, Practices and Effectiveness of implementation for modified waste segregation scheme

As observed in Table 8, there is a highly significant relationship (*p*-value=0.000) between the household awareness and attitude and effectiveness of the implementation of modified waste segregation. There is moderate positive correlation (R=0.544) between the two variables. About 29.5% of the variability of the effectiveness of implementation of modified waste segregation can be explained by the level of household awareness and attitude.

Table 8

Relationship between Household Awareness, Attitude and Practices and Effectiveness of Implementation for Modified Waste Segregation Scheme

Variable	Mean	SD	R-Value	R-Square	p-value	Result
Household awareness	4.29	0.45	0.544[a]	0.295	0.000[b]	Significant at 0.01
Household attitude	4.55	0.39				
Household Practices after Implementation of Modified Waste Segregation	3.97	0.48	0.272[a]	0.071	0.000[b]	Significant at 0.01

[a] Predictors: Awareness, Attitude, Practices
[b] Effectiveness of Modified Waste Segregation

Likewise, there is a highly significant relationship (*p*-value=0.000) between the practices and effectiveness of the implementation of modified waste segregation There is negligible positive correlation (R=0.272) between the two variables. About 7% of the variability of the effectiveness of implementation of modified waste segregation can be explained by the level of household awareness and attitude.

As their level of awareness, attitude and segregation practices increases, the perception on the effectiveness of the implementation also increases. This is similar to the study by Zsoka et al. (2012) which implies that correlation on awareness and attitude may regulate the course of one's environmental action.

Moreover, the residents' awareness and practices are critical in planning an effective form of solid waste management. A study by Alireza et al. (2016) has shown that community participation is an important aspect of solid waste management and solid waste management practices of households were usually related to what they were accustomed to, hence depended on practices found within the household's waste segregation, recycling, and encouragement to participate in environmental programs.

Conclusion

In accordance with the study's result, the awareness, attitude, practices before and after the implementation of modified segregation scheme, roles of linkages such as LGU and barangays significantly affect the perceived effectiveness for the implementation of modified waste segregation. As the level of awareness, attitude and practices of household respondents' increased, the perception on the effectiveness on the implementation of modified waste segregation also increased.

The study findings implied that a modified waste segregation scheme can significantly improve solid waste management practices among households. Furthermore, the study highlighted the importance of a comprehensive approach that includes education, adoption, and good governance practices which are key roles of policymakers and local authorities for effective implementation of solid waste management.

Recommendations

Based on the results of the study, the following are some of the respondent's recommendations to put into consideration.

1. In order to effectively implement the modified waste segregation at barangay level, it is advisable for each barangay to have its own garbage truck and Material Recovery Facility. This will enable the barangays to handle their solid wastes more effectively.

2. The conduct of environmental education about the new segregation scheme is valuable to inculcate the right attitude and practices for segregation at source. Likewise, IEC materials on modified waste collection and public trash bins is recommended to be displayed in prominent locations and online platforms, including social media.

3. It is recommended to include priority programs related to segregation in the annual budget of the barangay for environmental management. Additionally, acknowledging the top

performing barangays that successfully implement good solid waste management practices through incentives, grants, or recognition is beneficial.

4. Further research on this topic may be undertaken for encapsulation of programs and policies that will strengthen the modified segregation rule and household full compliance on waste segregation.

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Utilization of Different Nutrient Infused Chick Gel Mixtures and Its Effect on Chick Quality and Harvest Performance

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Abstract

The study was conducted to determine the response of Cobb® Broiler to different mixture formulations of D-Glucose Monohydrate and multivitamins. Specifically, it determined the growth performance, mortality rate, chick quality, and harvest recovery of Cobb® broiler as affected by different mixtures of D-Glucose Monohydrate and different gel consistency (soft, medium and hard). The experiment used a total of 1,440 chicks from the hatchery following the 2 x 3 factorial in Completely Randomized Design. There were six treatment combinations, and each was replicated three times. Each replication had 80 Cobb® broiler chicks to ensure validity of data. The results of the study showed better chick quality (Pasgar) score for mixture 2 (with higher amount of D-glucose monohydrate) only on Day 0 (farm) immediately right after the transport and at day 4, but no significant differences at day 7. In terms of gel consumption rate, Mixture 2 also had significantly higher consumption than mixture 1, significantly. In terms of body weight, gain in weight, harvest recovery, and mortality rate there were also no significant differences among treatments with different nutrient mixtures and gel consistency.

Keywords: *chick gel, chick quality, broiler, harvest performance*

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Introduction

Despite threats of diseases, importation, and other issues besetting the broiler industry, it continues to be one of the biggest enterprises in the Philippine animal industry. This is due to the good qualities of chicken meat, making it one of the most available and affordable type of meat in the market. In order to support broiler raisers, researches are needed to improve farm production performance starting from the newly-hatched chick.

Within twenty-four hours from hatching, chicks undergo sexing and quality assessment at the hatchery, and are then transported to the farms where they will grow as layers, broilers or breeders. Chick transport is considered as an early stressor since environmental factors can affect the chick quality and can contribute to first week mortality. During transport, dehydration can happen due to the length of transportation period, as well as the temperature and humidity fluctuation while on travel. Transport stress and dehydration can negatively affect the chicks' first week performance.

Researches have been made to lessen the chick transport effects on chick quality and first week performance, such as early nutrition (Hollemans et al., 2018), and the latest innovation is the chick gel, a jelly-based feed material that aims to hydrate the chicks while on transport (Brand). It promises to nourish the chicks with nutrients to support them during the first seven days of life. However, in terms of local applicability and cost efficiency, this product is not yet well studied and supported.

In this research, similar chick gel products that will use locally-available ingredients will be tested, with the aim of providing a sustainable solution for alleviating stress during chick transport and for maintaining chick quality from the hatchery to the farm. The widely-available Cobb broiler strain will be used as experimental animal due to its well-known adaptability to local conditions and its reliable growth performance.

The general objective of this research is to evaluate the response of Cobb® broiler to chick gel of different mixtures with different level of consistency. Specifically, it aimed to: 1) determine the quality of chick through Pasgar scoring; 2) compare the weight gain of broilers as affected by chick gel of different mixtures with different levels of consistency; and 3) compare the harvest recovery and mortality rate among chickens supplemented gel of different mixtures with different level of consistency.

Materials and Methods

Experimental Animals

The study used only Class A, or premium quality day-old Cobb broiler chicks from a reputable hatchery. A total of 1,440 chicks were divided into the 18 groups, or 80 chicks per replicate. For all the weighing schedules, all the 1,440 chicks were weighed by group. For the chick quality assessment via Pasgar method, only 25 % or 20 chicks per replicate were sampled.

Chick Gel Preparation

Prior to the day of chick transport, two mixtures were prepared using different ratios of nutrient mixture (Table 1a). These nutrient mixtures were used in making three types of gel consistencies (Table 1b).

Table 1a

Mixture Formulation of Nutrient-Infused Chick Gel (per 20 heads)

Ingredient	Mixture 1	Mixture 2
D- Glucose Monohydrate	150 grams	240 grams
Multi Vitamins	5 grams	5 grams
Water	2 liters	2 liters

Table 1b

Formulation of Gel Consistencies

Ingredient	Soft	Medium	Hard
Nutrient Mixture	2 liters	2 liters	2 liters
Jelly Powder	25 g	50 g	75 g

In cooking the chick gel, the jelly powder was mixed with the nutrient mixture (depending on the ratio), then placed into a clean cooking casserole and stirred constantly to avoid clumping. The mixture was poured into sanitized gelatin moulders and allowed to cool. To ensure that no cross contamination happened, the researcher used separate cooking utensils for every type of treatment mixture. All utensils were cleaned and disinfected prior to the actual gel preparation.

Once prepared, all mixtures were stored in a chiller to maintain cold temperature, and to avoid spoilage and nutrient degradation. Each chick gel mixture was cut into small pieces and placed in sanitized and labelled containers for easier identification and recording during supplementation.

Supplementation with Chick Gel

The prepared experimental gels were placed inside the chick crates 2 hours prior to chick transport. The chicks had a total of six (6) hours of exposure to the chick gel before and after transport until such time that they were put inside the brooding house.

Labelled containers of chick gel were placed at the center of each crate, where experimental chicks were then placed prior to transport. The chicks were placed in the crates with chick gel after they had undergone initial weighing and initial Pasgar scoring.

After two hours of waiting at the chick holding room, all gel mixture containers were retrieved and weighed, and then replaced with new pre weighed gel mixtures. All retrieved gels were then disposed to ensure only fresh gel mixtures were supplemented before the chick transport. After the gel replacements, chick baskets containing new gel mixtures were placed inside the chick delivery truck and started its transport.

The experimental animals arrived at the farm after two hours of transport. Gel mixture containers were once again collected and weighed to get the final weight after the two hours of exposure during transport. All retrieved gels were then disposed after weighing.

When the chicks were put inside the brooding house of the poultry farm, each cage already contained a new batch of chick gel. To complete the 6 hours total gel mixture exposure, the chick gel were placed inside the brooding cages for two hours, after which all gel mixtures were retrieved, thoroughly cleaned to remove rice hull (litter from the brooding cage floor), and then weighed to determine once again the gel consumption rate.

Chick Quality Assessment

Table 2

Pasgar Chick Assessment Criteria

Characteristic	Class A (Excellent)	Class B (Acceptable)	Class C (Cull)
Reflex	Chick can flip over within 3 seconds	Chick flips back over between 4-10 seconds	Over 10 seconds or fails to flip over
Navel	Clean and well- healed	Closed but slight abrasiveness	Not closed/string/button attached or discolored
Legs	Clean, waxy	Some dryness, pale	Dehydrated with vein protruding
Hogs	Clean, no blemishes	Slight blushing	Red color/ heavy blushing
Defects	Clean, no blemishes	Slight blushing	Legs with cuts/ abrasions; poor feathering; clubbed down; missing eye, cross beak, etc.

In the Pasgar method of chick quality assessment, Class A chicks are assigned perfect 10 points when excellent qualities are possessed (Table 2). One by one, chicks are evaluated through the standard parameters. In each category where the chick fails to qualify in the Class A standards, and gets only the description for Class B, a one-point deduction will be derived. A chick that has any characteristic described under class C is culled and removed from the trial flock. Pasgar scoring was done on Day 0 (Hatchery), Day 0 (Farm), Day 4, and Day 7.

Pasgar scoring evaluation was performed several times all througout the study. First was at the hatchery before the initial supplementation. All evaluated chicks were marked with red dye sprayed at the back of their head for easier identification during the second pasgar evaluation after the 6 hours supplementation where same samples were evaluated. Pasgar scoring was also done during the fourth day and seventh day of growing so the ong term effect of the gel mixtures was meassured.

Figure 1

Sample Pasgar Scoring

Sample Pasgar Scoring

Chick	Reflex	Navel	Beak	Hocks	Belly	Score
1	0	1	1	0	0	8
2	0	0	0	0	0	10
3	1	1	0	0	1	7
.	0	0	0	0	0	.
.	0	1	0	0	0	.
.	0	1	0	0	0	.
50	1	0	0	1	0	8
Total						435

Sample Computation:
Average Pasgar Score = 435/50 = 8.7
Navel Problems in 29 out of 50 Chicks = 58%

Weighing

Weighing of the experimental animals was performed by batch while the chicks are inside crates and computed only the average weight. Hence, all chicks or chickens are placed in pre-weighed baskets or crates, the gross weight is recorded, and then the gross weight was divided into the actual number of heads weighed to get the average weight. This weighing process was done before the supplementation and chick transport, after supplementation or arrival at the farm, and during the 4th, 7th, 14th, 21st, and 28th day of the chickens.

Care, Medication and Harvest

All experimental animals followed the standard care and medication program of Bounty Fresh Food Inc. such as feeding program, lighting program and vitamin supplementation program to ensure chickens were raised in a stress-free environment and free from life threats such as pest and diseases. The experimental animals were also harvested following Bounty Fresh Food Inc. standards to ensure it followed the humane harvesting process.

Data Gathered

The following data were gathered, organized, and subjected to analysis:

1. Chick quality. Chick quality was assessed using Pasgar scoring criteria such as Reflex, Navel, Legs, Hock and Beak. It was done on Day 0 (Hatchery) Day 0 (Farm) Day 4th and 7th.
2. Weight of the Cobb® broiler, this was gathered on the day 0, 4th, 7th, 14th, 21st and final weight on 29th.
3. Average gain in weight, this was gathered through the formula below
   a. AGW = Final weight – Day 0 Hatchery weight
4. Harvest performance. The harvest performance was assessed through getting the harvest rate of the flocks.
   a. Harvest Rate = (No. of chicks harvested/ Total number of chicks) x 100
5. Consumption rate. This was gathered through getting the consumption rate of broiler chicks on the chick gel

Experimental design and treatments

The experiment tested two factors, namely: nutrient mixtures and gel consistencies. The experimental treatments for Factor A (nutrient mixture) were: A1 – Mixture 1, A2 – Mixture 2; and for Factor B (gel consistency) were: B1 – soft, B2 – medium, and B3 – hard.

The experiment was laid out following the 2x3 factorial in Completely Randomized Design (Figure 1), for a total of six treatments replicated three times, or a total of 18 groups. The experimental lay-out was generated using Statistical Tool for Agricultural Research (IRRI, 2013).

Figure 2

Lay-out of the experiment.

A1B1 R3	A2B3 R2	A1B3 R3
A1B3 R1	A1B2 R1	A1B2 R3
A2B1 R3	A1B1 R3	A2B3 R3
A2B3 R1	A2B2 R2	A2B2 R1
A1B3 R2	A2B1 R2	A1B2 R2
A2B2 R3	A2B1 R1	A1B1 R2

Statistical Analysis

All the data gathered from the experiment were analyzed using the Statistical Tool for Agricultural Research (STAR) developed by International Research Rice Institute (2013), employing the analysis of variance (ANOVA) of the Completely Randomized Design. Means were compared using Least Significant Differences (LSD) when there were significant differences.

Results and Discussion

Chick Quality via Pasgar Score

Table 3 shows the Pasgar scores of Cobb® broiler from Day 0 (Hatchery) to Day 7 as affected by different nutrient mixtures of D-Glucose Monohydrate and multivitamins in different gel consistencies.

It is revealed that on day 0 (hatchery), the chicks showed similar Pasgar scores, with a range of 9.80 to 9.87. However, results for day 0 (farm) and day 4 showed that chicks supplemented with Mixture 2 (with higher amount of D-glucose monohydrate) had significantly higher PASGAR scores with a mean of 9.84, compared to chicks given with Mixture 1 with a mean of 9.77. This conforms to Warsito, et al. (2021) who concluded that the use of dextrose leads to better performance of birds as it helps to improve the health of the chicks.

On day 7, chicks supplemented with different mixtures of d-glucose monohydrate showed uniform Pasgar results, with a range of 9.93-9.98. The uniformity at one week age can be due to the quality of chicks raised, all of which are class A which had excellent reflex, navel, legs, hocks and free form defects. Lima (2019) emphasized that healthy chicks are a good starting point for poultry performance. Aside from the chicks were all from class A and were raised in a controlled environment, the quality score of chicks became even higher at day 7 because older chicks are expected to rate higher in many Pasgar criteria, especially in reflex and navel.

Table 3

Chick Quality (Pasgar) Score of Cobb® Broiler Affected by Different Mixtures of D-Glucose Monohydrate and Multivitamins with Different Levels of Consistency

Day of Assessment	Nutrient Mixture	Consistency			
		Soft	Medium	Hard	Mean
Day 0 (Hatchery)	Mixture 1	9.82	9.87	9.80	**9.83**
	Mixture 2	9.82	9.87	9.87	**9.85**
	Mean	**9.82**	**9.87**	**9.84**	
Day 0 (Farm)	Mixture 1	9.72	9.87	9.73	**9.77b**
	Mixture 2	9.83	9.85	9.85	**9.84a**
	Mean	**9.78b**	**9.86a**	**9.79b**	
Day 4	Mixture 1	9.87	9.9	9.87	**9.88b**
	Mixture 2	9.87	9.95	9.93	**9.92a**
	Mean	**9.87**	**9.93**	**9.9**	
Day 7	Mixture 1	9.98	9.93	9.98	**9.96**
	Mixture 2	9.95	9.98	9.95	**9.96**
	Mean	**9.97**	**9.96**	**9.97**	

No significant effect was observed in terms of the interaction of the two factors; the six treatment groups were statistically comparable.

Body Weight

Table 4

Bodyweight (g) of Cobb® Broiler as Affected by Different Mixtures of D-Glucose Monohydrate and Multivitamins with Different Levels of Consistency

Day of Assessment	Nutrient Mixture	Consistency			
		Soft	Medium	Hard	Mean
Day 0 (Hatchery)	Mixture 1	43.67	42.67	44.00	**43.45**
	Mixture 2	44.00	43.33	43.67	**43.67**
	Mean	**43.84**	**43.00**	**43.84**	
Day 0 (Farm)	Mixture 1	46.00	44.33	46.00	**45.44**
	Mixture 2	45.67	46.00	45.67	**45.78**
	Mean	**45.84**	**45.17**	**45.84**	
Day 4	Mixture 1	112.67	109.67	111.00	**111.11a**
	Mixture 2	108.33	108.67	107.67	**108.22b**
	Mean	**110.5**	**109.17**	**109.34**	
Day 7	Mixture 1	183.33	184.00	181.33	**182.89**
	Mixture 2	186.63	188.33	183.00	**185.99**
	Mean	**184.98**	**186.17**	**182.17**	
Day 14	Mixture 1	482.33	469.67	471.67	**474.56**
	Mixture 2	498.67	491.67	448.00	**479.45**
	Mean	**490.50a**	**480.67ab**	**459.84b**	
Day 21	Mixture 1	968.33	970.00	981.67	**973.33**
	Mixture 2	974.67	996.33	995.67	**988.89**
	Mean	**971.50**	**983.17**	**988.67**	
Day 28	Mixture 1	1,403.67	1,414.00	1,397.00	**1,404.89**
	Mixture 2	1,384.67	1,437.33	1,405.67	**1,409.22**
	Mean	**1,394.17**	**1,425.67**	**1,401.34**	

Table 4 shows the weight of Cobb® broiler affected by different mixtures of D-Glucose Monohydrate and multivitamins with different levels of consistency.

For day 0, both at the hatchery and farm levels, the Cobb® broilers showed no significant differences in bodyweight, with a range of 42.67-44.00g at the hatchery, and 44.33-46.00g at the farm. These results were used to ensure random distribution of experimental animals.

On the 4th day, birds supplemented with different mixtures showed significant differences on the weight where birds, with mixture 1 showing a significantly higher weight having an average of 111.11g, compared to birds with mixture 2 having an average of 108.22g. On their 7th day, the weight became non-significantly different among birds with different treatments, with a range of 181.33-188.33g, and the average for birds with Mixture 1 was 182.89g and for Mixture 2 was 185.99g.

Meanwhile, on the 14th day, there was observed significant differences among the levels of consistency, where birds given with soft mixture had a highest weight, although still comparable to chicks with gel of medium consistency, and the latter also has comparable weight to birds given with hard consistency. On the 21st day, birds showed comparable weights despite of using different treatment combinations. Analysis of Variance further revealed no significant differences on the final

weight at day 28 of Cobb® broiler chickens as affected by different mixtures of D-Glucose Monohydrate and multivitamins.

In terms of the effect of different consistencies (factor B) on the response variable, analysis of variance revealed no significant variation. However, numerically, birds supplemented with treatments with gel of medium consistency had the highest final weight with 1,425.67g, followed by birds with treatments in hard consistency with 1,401.34g, and by birds with treatments in soft consistency with 1,394.17g.

In terms of the interaction of the two factors, no significant effects are observed statistically. This uniformity in weight during the last weeks of production is due to the class of chicks raised which is class A, as emphasized by Lima (2019) that healthy chicks will give good growth performance.

These results also conform with Hollemans et al. (2018), who concluded in their study that beneficial effects of early chick nutrition provided post-hatch have beneficial effects only on the first two weeks, but the beneficial effects are less evident in later life of chickens. The uniform quality of management implemented during the trial in terms of the controlled environment, feeding, and farm hygiene and sanitation systems also contributed to the uniform weight of the chickens.

Gain in Weight

For the gain in weight, Table 5 shows that in terms of the individual effects of Factor A (Mixtures) and Factor B (consistency), there were no significant differences among groups. In terms of the interaction of the two factors, the birds also showed similar response on the treatment combinations. The obtained final gain in weight ranged from 1,340.67-1,394.00g among the six treatments.

Table 5

Average Gain in Weight (grams) of Cobb® Broiler as Affected by Different Mixture of D-Glucose Monohydrate with Different Levels of Consistency

Mixture	Consistency			
	Soft	Medium	Hard	Mean
Mixture 1	1,360.00	1,371.33	1,353.00	**1,361.44**
Mixture 2	1,340.67	1,394.00	1,362.33	**1,365.67**
Mean	**1,350.34**	**1,382.67**	**1,357.67**	

The result of the study is in line with the study of Baykalir et al. (2021) who used D-Glucose monohydrate to assess the growth performance of geese. The result of the latter revealed that the aforesaid supplement did not show any effect on the growth of the experimental birds.

Chick Gel Consumption

Table 6 shows the consumption rate of Cobb® broiler on chick gel with different mixtures of D-Glucose Monohydrate and multivitamins, as affected by different mixtures, different consistency levels, and their combination.

Table 6

Chick Gel Consumption (g) of Cobb® Broiler as Affected by Different Mixtures of D-Glucose Monohydrate and Multivitamins with Different Levels of Consistency

Mixture	Consistency			
	Soft	Medium	Hard	Mean
Mixture 1	28.44	21.90	27.36	**25.90** [b]
Mixture 2	35.03	32.73	31.67	**33.14**[a]
Mean	**31.74**	**27.32**	**29.52**	

Analysis of Variance revealed that the consistency of the D-Glucose Monohydrate did not significantly affect the response variable. It is revealed that the consumption rate on D-Glucose Monohydrate of the Cobb® broiler will remain uniform regardless of its consistency. The rate ranged from 27.32-31.74 among the three consistency levels.

In terms of the mixture (Factor A), Cobb® broiler supplemented with Mixture 2 of D-Glucose Monohydrate showed significantly higher consumption rate with 33.14g than experimental animal supplemented with Mixture 1 with 25.90g.

The different mixtures significantly affected the response variable on consumption by the Cobb® broilers due to Mixture 2 having higher amount of D-glucose monohydrate. According to Rodriguez et al. (2016), higher level of energy can positively affect the feed and consumption efficiency of broiler chickens.

However, the interaction of the two factors did not significantly affect the response variable. The consumption rate ranged from 21.90g to 35.03g among the six treatment combinations.

Harvest Recovery

Table 7 shows the harvest recovery of the experimental animals as affected by different mixtures of D-Glucose Monohydrate with different levels of consistency. ANOVA revealed no significant variation on the harvest recovery on birds supplemented with mixtures 1 and 2 with 98.61% and 98.89% harvest recovery in the two mixtures, respectively. In terms of gel consistency, no significant differences were observed to birds supplemented with treatments with soft, medium, and hard consistency, with a range of 98.54% to 98.96% among the three consistency levels.

Table 7

Harvest Recovery (%) of Cobb® Broiler Affected by Different Mixture of D-Glucose Monohydrate with Different Levels of Consistency

Mixture	Consistency			
	Soft	Medium	Hard	Mean
Mixture 1	98.75	98.75	98.33	**98.61**
Mixture 2	98.75	99.17	98.75	**98.89**
Mean	**98.75**	**98.96**	**98.54**	

Furthermore, the interaction of the two factors showed no significant differences on the response variables. Thus, the supplementation of the D-glucose monohydrate with different consistency did not affect the harvest recovery on flocks, with a range of 98.33% to 99.17% among the six treatment combinations.

Since all the birds received supplementation, they prove the assertion of Shengru (2019) that D-glucose monohydrate supplementation can improve the growth performance of broiler in terms of enhancing the digestive function of gut which improve apparent digestibility and digestive enzyme and can improve health which leads to low death and morbidity and leads to low depletion.

Mortality

Table 8 shows the mortality rate on broiler affected by different mixtures of D-Glucose Monohydrate with different levels of consistency.

Table 8

Mortality (%) on Cobb® Broiler Affected by Different Mixture of D-Glucose Monohydrate with Different Levels of Consistency

Mixture	Consistency			
	Soft	**Medium**	**Hard**	**Mean**
Mixture 1	1.27	1.27	1.70	**1.41**
Mixture 2	1.27	0.83	1.27	**1.12**
Mean	**1.27**	**1.05**	**1.49**	

ANOVA revealed that different mixtures did not significantly affect the mortality rate of the Cobb® broiler. The obtained average mortality rate for Mixture 2 was 1.12%, while Mixture 1 had 1.41%.

In terms of the effect of different consistency, ANOVA also revealed no significant differences. The mortality rates on broilers supplemented with treatments in different consistency levels are statistically similar at the range of 1.05% to 1.49%. Also, the interaction of the two factors showed no significant effect on the latter response variable.

According to Shengru (2019), d-glucose monohydrate or dextrose supplementation can improve the growth performance of broiler in terms in enhancing the digestive function of gut which improve apparent digestibility and digestive enzyme and can improve health which leads to low death and morbidity.

Conclusion

Based on the results of the experiment, the following conclusions were drawn: 1) Mixture with higher amount of D-glucose monohydrate had a positive effect on the quality of chicks after supplementation until 4th day; 2) Different mixtures with different consistency showed no effect on the weight and weight gain of Cobb® broiler; and 3. Different mixtures with different consistency also showed no effect on the harvest recovery and mortality rate on Cobb® broiler.

Recommendations

Based on the results, the following recommendations are made: 1) Use of chick gel with 240 g of d-glucose monohydrate may be done by broiler farms if they want to maintain chick quality during their early days of life; 2) Utilize chick gel for Class B broiler chicks may be studied to determine if it can improve chick quality and performance after supplementation; and 3) Use of chick gel may be studied in farms without controlled environment system to see if supplementation can improve growth performance if management and environment are not optimum.

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English Spelling Ability Improvement through Pop Art and Drill

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Abstract

This action research employed a sequential explanatory mixed-methods strategy to explore the influence of pop art and live spelling drill as learning interventions in the spelling ability of Grade 2 pupils in a single class of a public elementary school. This spelling ability is considered one of the least learned competencies of the pupils based on the diagnostic test and the teacher's classroom-level English assessment. The respondents were grade 2 pupils who agreed to attend the face-to-face classes during the third and fourth quarters of the school year 2021-2022 wherein the parents, through the mandate of the Department of Education had the option to send their children to school and attend onsite classes. A validated, researcher-made pop-up book was utilized as a learning material partnered with a live spelling drill was concurrently used to enhance the spelling ability of the participants. The pop-up books were distributed to the participants' parents and taught to them by the parents themselves as supplementary materials. It was revealed in the pre and post-tests that the average scores of the participants exhibited a significant difference. The mean score in the written spelling activity in the post-test is higher (M=6.00, SD=1.10) than in the pre-test (M=2.05, SD=1.29) $t(19) = -14.83$ (p=0.001). This finding was further strengthened by the feedback obtained from the parents of the pupils who were interviewed after the intervention implementation. Among the themes of the intervention include the increased interest of the pupils in the spelling practice at home, increased vocabulary, and enjoyment of using the pop art materials.

Keywords: *Action Research, Competency, Pop art book, Spelling Drill, Vocabulary*

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Introduction

The Philippines is a language-diverse country with more than 100 languages (Galang, 2000) spoken in the entire archipelago. Through the course of history, particularly the colonization of the different nations in the country, the selection of a national language that will be the medium of instruction in all sectors and across industries had been challenging (Barrot, 2018). It was then that the government chose English as the language of government, media, and trade. This also prompted the government to guarantee that the English language proficiency of Filipinos is sustained through education. One of these measures was the 1974 Bilingual Education Policy (BEP) which aims to use the English language as the medium of instruction in science and mathematics and the teaching of English as a subject in schools.

Presently, the K-12 basic education curriculum still upholds the English language proficiency of Filipinos for a better grasp of English and linguistic competence in general. The English subject is taught in kindergarten and has been a constant subject until twelfth grade. The English curriculum of the K-12 program applies the most essential learning competencies (MELCs) which refers to the knowledge, understanding, skills, and attitudes that students need to demonstrate in each learning activity. These competencies are necessary to develop a learner's practical and lifelong skills for learning amidst a crisis which will eventually lead the learner to have a successful life.

Spelling is part of the MELCs and a part of the integrated language arts domains of the K-12 curriculum. Spelling is a complex skill that is important to both writing and reading. It has been demonstrated in many studies that spelling has a high correlation to reading comprehension in which both competencies largely depend on language proficiency. Parallel to reading, spelling involves knowledge of the alphabetic system in terms of letter names, functional units of letters or letter clusters, amalgamation of phonemes, dividing of words into phonemes, and synthesizing phonemes into graphemes (written symbols) (Leong et al., 2005). One's spelling ability does not develop naturally. Like reading and writing, it needs to be taught overtly and explicitly. Moreover, as Ehri (2000) reported, poor spellers are also poor readers in most cases since spelling and reading develop synergistically and reciprocally. Because spelling is highly imperative to children's literacy development, it is essential that they master this skill. This mastery should help abate spelling constraints on students' writing, as well as ease their acquisition of foundational reading skills (Graham & Santangelo, 2014) thus, must be developed early on in the child's schooling years.

Learning to spell is a developmental process. According to the stage theory of spelling development, students improve from being preliterate to alphabetic spellers as they master letter-sound correspondence. Subsequently, they learn about within-word orthographic patterns (e.g., CVC spellings) and, afterward, about complex syllable patterns and derivational patterns (Moats, 2000; Joshi & Aaron, 2005; Otaiba et al., 2010). More recently, there have been researches that have emerged and purported the idea that spelling does not develop in such distinct stages, instead, students learn to spell by connecting their knowledge about the alphabet, phonology, orthography, and morphology across time with increasing efficiency (Treiman & Bourassa, 2000).

A pop-up book is generally described as a type of mechanical or movable book with pages that rise or stand when opened to simulate a three-dimensional form and is constructed with heavy cardstock or board paper instead of thinner paper. Pop-up books are popular among children and can

offer great interest and engagement to young learners especially those at primary levels (Mahadzir, 2013). Similarly, Van Dyk et al. (2010) defined pop-ups as various folding devices that cause figures to lift, pop up, rise and unfold, or unfold and extend when a page is opened or turned. They further explained pop-ups as a device that can be folded and manipulated to give a sense of 3D reality in the viewers' eyes, creating an effect that is attractive and manipulative for young and old people, hence, a book that can create an interactive experience for reading.

Despite the breakthroughs in digital technologies and the advent of 21st-century learning, pop-up books are still popular among children. Regardless of the oldness of pop-ups, it is regarded as popular art or pop art in modern society and has been proven an effective visual material in the children's learning process including in reading and writing development (Ellis et al., 2005; Triana, 2017).

On the other hand, the drill technique in classrooms could promote knowledge acquisition and improve the memorization skills of students due to its repetitive nature. Drills are thought to be a crucial component of language learning. The drilling approach utilized exercises to present and practice grammatical structures while promoting the development of positive habits. The use of oral drills as a method for language practice remained ubiquitous in many ways that are considered to be communicative despite the technique's heavy reliance on the notion that language learning occurs through imitation. In many classroom settings, drills are done in a controlled phase to help students develop accuracy before moving on to a more communicative and complex language lesson.

The Covid-19 pandemic has created a learning gap in basic education. Because of the unprepared shift to online, modular, and flexible learning modality, students experienced inconvenience in their education while knowledge and skills development was hampered. To contain the pandemic, schools transitioned to home-based and remote learning which led to several challenges in both developed and developing nations (Schleicher, 2020). Some of these problems include internet connection problems, parents who lack language proficiency in English-centered subjects, and practical exams that need special devices and equipment unavailable at home. Students from low socio-economic backgrounds have also been described to experience triple disadvantage, with a home environment less conducive to learning, diminished access to digital tools, and higher vulnerability to the health and financial impacts of the pandemic (Allam et al., 2020)

The unique case of one public elementary school in San Miguel, Bulacan was observed and became the focus of this study. Particularly, the grade two pupils, who, based on their spelling test scores and diagnostic exam, were empirically characterized by their classroom teacher as poor spellers. Similarly, the spelling ability of these pupils was also deemed as one of their least learned competencies.

Grade two teachers apparently saw this situation as the repercussions of the lack of focus of their pupils during online classes, high nonattendance or absence because of internet connectivity problems, lack of interest in completing the self-learning module activities, and fragmented support and guidance of the parents in the blended learning in the middle of the Covid-19 pandemic. Utilizing pop-up book and drill as a classroom intervention, the present study attempted to demonstrate the effectiveness of this synergized learning strategy in spelling improvement among selected pupils in a face-to-face setup.

Literature Review

Contrary to the continuously growing body of evidence on learning to read in alphabetic writing systems, the development of spelling has attracted less attention in terms of exploration. Yet learning to spell carries a more difficult concern to the child than learning to read, especially in an obscure orthography such as English where the link between the phonemes and graphemes is usually unpredictable.

Treiman and Bourassa (2000) claimed the idea that spelling does not develop in such distinct stages, instead, students learn to spell by connecting their knowledge about the alphabet, phonology, orthography, and morphology across time with increasing efficiency. The early study of Treiman (1993) positioned that children show sensitivity to the orthographic restrictions of the system they are absorbing from a relatively early stage and are more likely to produce grapheme sequences that occur in the orthography than those that violate positional constraints (ex. "kight" for kite). Despite these early influences of exposure to print, young children often rely on a “sounding out” and “sounding like” strategy in which spelling conventions are not utilized.

In one study (McBride-Chang et al., 2005), they found that morphological awareness predicted vocabulary size, monitoring and control for phonological awareness, timed or speed rate-based naming, and word reading measures, in a given population of students in kindergarten and second grade.

Many authors have hypothesized that students' spelling develops in stages that parallel reading development (Ehri, 2000; Moats, 2000). According to the stage theory of spelling development, learners progress from preliterate to alphabetic spellers as they master the letter-sound correspondence of their language. Then they learn about within-word orthographic patterns like CVC spellings, and subsequently, about complex syllable patterns and derivational patterns.

With respect to writing, Graham (1999) stated that poor spelling ability has been hypothesized to weaken the composition process via straining cognitive resources and interfering with higher order skills that are necessary to produce well-written academic writing materials like essays, position papers, and other prose outputs. Accordingly, if students have problems and complications with spelling, they may then be impaired in developing wider writing skills (Graham et al., 2002).

Insights on the value of practice and repetition as a means to improve one’s skill could be used in language development. Jones et al. (2016) had first and second grade pupils first take a pretest and then learn spelling words using self-corrected tests known as rainbow writing. Often appearing on lists of fun and enjoyable spelling activities. This rainbow writing method requires copying words multiple times in different colors. In each experiment, practice testing yielded better ability to spell words on a posttest that occurred weeks later. Among 1st grade learners, the scale of pretest-to-posttest improvement from practice testing exceeded that from rainbow writing by over 300%. Additionally, the pupils consistently reported liking testing more than rainbow writing by an approximately three-to-one margin. These results counter the claim that testing only reflects “short-term memory” and disprove the suggestion that testing and repetition drills are boring and bland.

Caravolas et al. (2001) investigated the first 3 years of schooling of British children to uncover the developmental relationship between spelling and reading ability and to identify the component skills

of their spelling. Large battery of tests, including reading, phoneme awareness, letter-sound and letter-name knowledge, memory, and verbal and nonverbal IQ assessments were used. Spelling productions were assessed both for phonological believability and for conformist accuracy. A path analysis revealed that phoneme segmentation and letter-sound knowledge were the precursor skills of early phonological spelling ability. Correspondingly, although initial phonological spelling ability predicted later reading, early reading ability did not impact later phonological spelling ability. These indicated that skilled spelling requires a foundation in phonological transcoding ability which in turn enables the formation of orthographic illustrations.

Locally, Barrot (2018) mentioned the importance of spelling as a precursor to reading as well as writing and should be integrated in the 21st century curriculum of English learning in the Philippines. Parallel to this, Sicam and Lucas (2016), found that Filipino students have very high positive attitude towards English and Filipino where females have significantly higher positive attitudes towards English than males. Meanwhile, it was also revealed that socio-economic statusy is significantly related to positive attitudes towards English language. Gender is significantly related with instrumental language orientation in Filipino; age is significantly related to instrumental language orientation in Filipino and integrative language orientation in English.

Materials and Methods

Research Design

The current study utilized the sequential explanatory mixed method approach. In this approach, the quantitative data was initially collected followed by the qualitative data. The quantitative data in this study was acquired through the administration of an oral and written spelling drill and the use of the pop-up book, “Let’s Enhance Your English Spelling Ability” given to participants. To collect the data, a pre-experimental research design, specifically, the one-group pretest-posttest design was used.

Qualitative data gathering ensued wherein the researchers carried out semi-structured interviews among the randomly selected parents of the participants and obtained feedback on the proposed interventions after the conduct of the study. The feedback were consolidated through a narrative presentation and thematic analysis.

Sampling Method

Due to school restrictions brought about by the pandemic in terms of participation in face-to-face classes, the research adopted convenience sampling in the selection of respondents. This type of non-probability sampling relies on data from population members who are conveniently available to participate in the study.

Respondents

The respondents of the study were the selected grade 2 pupils who agreed and consented to participate by their parents in face-to-face classes at Tartaro Elementary School, San Miguel, Bulacan. The respondents consisted of 8 males and 12 females a total of 20 pupils aged between 7-8 years old

during the time of the study. They were also pre-selected by the Grade 2 chairperson of Tartaro Elementary School since they were already evaluated as below-average performers in the English subject and had poor to below-average spelling ability. All of the participants had not yet experienced the spelling book pop art prior to the execution of the intervention.

Instruments

A total of four instruments were used and developed in the study. The first instrument was the researcher-made and validated pop-up book, *Let's Enhance Your English Spelling Ability.* The book had two parts. Part 1 comprised of letters A to L and is 28 pages. Part 2 had 32 pages and was composed of Letters M to Z. Each letter had three pictures of different objects and each picture has a word below it that identifies and refers to the object in the picture. All the objects in the pictures were used in a sentence. The words included in the pop art were taken from the grade 2 English textbook, *Developing Reading Power* and *Early Grade Reading Assessment* (EGRA).

Furthermore, the books were validated by the validation team from the Tartaro Elementary School comprising of the school principal, learning resources management and development system (LRMDS) coordinator, English coordinator, and a teacher III in the participant school. The two-part pop-up books, *Let's Enhance Your English Spelling Ability* was recommended for reproduction for school use only on April 25, 2022, after passing the validation. For clarity of understanding, the words pop-up and pop art will be used interchangeably in this paper.

The contents of the pop art reading material were divided into three sections. The first section displayed the alphabet and three examples of pop-up picture words that corresponded to the letter of the alphabet being learned on that page. The second section of the pop-up book was the activity sets where the pupils wrote the missing letter to correctly spell the word asked. The images used in the activity were the same in the first section of the book. The last section of the book presented an image only with no clue letters to complete the name of the image. This exercise directed the pupils to name the image on the page referring only to the image as hints.

The second instrument was the sets of questionnaires for the Live Spelling Drill consisting of 10 items for written spelling and another 10 items for oral spelling. The words that were asked to be spelled during the Live Spelling Drill were taken from the Grade 2 English books entitled, *Developing Reading Power*, *Early Grade Reading Assessment* (EGRA), and the pop-up book, *Let's Enhance Your English Spelling Ability.*

The third instrument was the questionnaire for the pretest-posttest of the pop art *Let's Enhance Your English Spelling Ability,* which also had 20 items. The words included in the written spelling activity (considered a pretest-posttest questionnaire) were also taken from Grade 2 English books entitled, *Developing Reading Power* and *Early Grade Reading Assessment* (EGRA) and the pop-up book, *Let's Enhance Your English Spelling Ability.*

The fourth and last instrument was the questions for the semi-structured interview with the randomly selected parents who taught the content of pop art to their children at home. The questions were: (1) *Paano nagustuhan ng inyong anak ang disenyo at nilalaman ng pop art book?* (How did your child find the design and content of the pop art book?); (2) *Nakitaan ba ninyo ng interes sa spelling ang inyong anak habang tinuturuan ninyo siya gamit ang pop art book?* (Did you notice any spelling interest

in your child while you are teaching him/her the contents of the pop art book?); (3) *Kumusta ang spelling ability ng inyong anak pagkatapos gamitin ang pop art book?* (How was your child's spelling ability after using the pop art book?); and (4) *Mairerekomenda ba ninyo ang pop art book na ito sa ibang mga magulang ng elementarya?* (Will you recommend this pop art book to other parents of elementary pupils?).

Classroom Intervention Implementation

The classroom intervention was implemented in the third and fourth quarters of the school year 2021-2022. Prior to the execution of the intervention, the school administrators of Tartaro elementary school including the school principal and grade two chairperson informed the parents of those that agreed to attend the face-to-face classes and the identified respondents about the conduct of the research and the role of their children as participants. Permission and all the necessary documents were secured by the researchers before the actual application of the intervention.

The intervention began with the conduct of a 20-item spelling pre-test (written) in which the teacher pronounced the words to be spelled in the class using the Filipino accent. Afterward, a briefing among the grade 2 participants was held to inform them about the pop art, *Let's Enhance your English Spelling Ability* books which they were provided for each as a learning material to improve their spelling skills. The pupils were also instructed that the pop art books were to be read by them under the guidance of their parent or designated guardian at home. Moreover, the pupils were also informed about the live spelling drill consisting of oral and written spelling activities integrated into their daily classes for the two remaining quarters as part of their English subject exercises. Oral and written spelling drills were alternately conducted every week.

During the intervention, all the participants were asked to join the oral and written spelling drill before the class discussion. At the end of the intervention period, a 20-item post-test written spelling activity was conducted. Subsequently, a semi-structured interview with randomly selected parents was also carried out to obtain their perceptions and feedback on pop art books as supplementary reading material at home.

Figure 1

The First Page of the Pop-up Book Showing Words that Start with the Letter A

Research Ethics Consideration

To conduct the study, the researchers sought approval from the school principal of the elementary school. A meeting between the parents, the school administrators, and the researchers also ensued to ask for consent and brief the parties on the classroom intervention and data collection that would happen. Confidentiality of the identities of the participants was maintained throughout the conduct and reporting of the outputs of the study. The researchers ensured that the stipulations in the Research Management Guidelines of DepEd Order No. 16, s. 2017, were followed throughout the conduct of the study.

Data Collection

Scores from the pre-and post-assessments were recorded while the responses from the interviews were consolidated. A rubric with a four-point verbal description and three criteria was used to determine the spelling ability of the grade two pupils before and after the intervention's application. The verbal descriptions were: Always Observed (3.40-4.00), Sometimes Observed (2.60-3.39), Rarely Observed (1.80-2.59), and Not Observed (1.00-1.79). The criteria cited were: (1) Number of English words spelled correctly; (2) Time consumed in the spelling activity/test and (3) Attention given towards live spelling activity. To acquire data in the third criterion, the class was video captured and photographed during the intervention implementation with permission from the parents and the school administrators.

Data Analysis

Paired t-test was used to analyze the quantitative data from the pre-test and post-test. All quantitative data were processed using SPSS V26 at 0.05 alpha level. On the other hand, the consolidated perceptions from the parents were subject to thematic analysis. The method of Braun and Clarke (2006) involving six phases of thematic analysis was used to generate findings. These phases are: 1. Familiarizing oneself with the data; 2. Generating initial codes; 3. Searching for themes; 4. Reviewing themes; 5. Defining and naming themes, and 6. Producing the report.

Results and Discussion

Improved Oral Spelling Ability of the Grade 2 Pupils

Before the intervention was employed among the grade 2 participants, a 20-item spelling activity was conducted. There was also an oral spelling activity before the distribution of the pop art books to the pupils. The scores were recorded and ranked based on the rubric used in the study. It was a distinguished poor performance among the pupils. In scaling the number of English words spelled correctly, majority of the pupils did not show any spelling proficiency (M=1.65, f=11) and was described as *not observed (NO)* as shown in Table 1.

This finding was also observed in the time consumed in spelling activity and the attention given to the live oral spelling activity which was also regarded as not observed (M=1.60, f=11). More than half of the pupils could not spell 10 words within 15 minutes. Meanwhile, only 9 students showed attention in continuing the spelling activity from 5-8 words then they informed the teacher that they could not

finish the activity. On the contrary. There were 11 pupils who showed attention in spelling the given 3-4 words.

During the intervention pursuit for two months, the live oral and written spelling drill was conducted alternatingly every week before the actual topic discussion inside the classroom. The participants were filmed during the spelling drills and were observed for their attention towards the activity. A mean of 2.35 was obtained in the criterion number of English words spelled correctly, described as *Rarely Observed (RO)*. As for the attention given towards live spelling activity, a mean of 3.00 was calculated and was categorically translated into *Sometimes Observed (SO)* (Table 2).

Table 1

Oral Spelling Ability of Grade 2 Pupils before the Drill and Pop Art Intervention

Criteria	N	Frequency (f)				Mean	Verbal Description
		AO (4)	SO (3)	RO (2)	NO (1)		
1. Number of English words spelled correctly	20	1	2	6	11	1.65	Not Observed
2. Time consumed in spelling activity	20	1	1	7	11	1.60	Not Observed
3. Attention given towards live spelling activity	20	1	3	5	11	1.70	Not Observed
Grand Mean	20	3	6	18	33	**1.65**	**Not Observed**

Always Observed (AO) (3.40-4.00); Sometimes Observed (SO) (2.60-3.39); Rarely Observed (RO) (1.80-2.59), and Not Observed (NO) (1.00-1.79).

Then at the end of the study, after the post-test, the last oral spelling activity took place in which 14 pupils had been rated *Always Observed (AO)* in the number of English terms they can spell out (M=3.60). This observation mirrored that of the consumed time in spelling (M=3.55) and attention in the spelling drill (M=3.75) as presented in Table 3 and was also viewed as *Always Observed (AO).*

Table 2

Oral Spelling Ability of Grade 2 Pupils during the Drill and Pop Art Intervention

Criteria	N	Frequency (f)				Mean	Verbal Description
		AO (4)	SO (3)	RO (2)	NO (1)		
1. Number of English words spelled correctly	20	4	4	7	5	2.35	Rarely Observed
2. Time consumed in spelling activity	20	2	7	6	5	2.30	Rarely Observed
3. Attention given towards live spelling activity	20	9	4	5	2	3.00	Sometimes Observed
Grand Mean	20	15	15	18	12	**2.55**	**Rarely Observed**

Always Observed (AO) (3.40-4.00); Sometimes Observed (SO) (2.60-3.39); Rarely Observed (RO) (1.80-2.59), and Not Observed (NO) (1.00-1.79).

The grand means before, during, and after verbally described as *Not Observed, Rarely Observed,* and *Always Observed*, respectively depicted an observed improvement in the spelling skills of the pupils in an oral spelling setting. Several researches have demonstrated the link of spelling to reading and writing and its importance has been highlighted across industries, from education to business and marketing even in advertising and website development (Pan *et al.*, 2021; Graham & Santangelo, 2014; Oelke et al., 2012). Explicit spelling instruction such as the assimilation of spelling in the curriculum and becoming part of instruction and lessons have been avowed to be effective in improving the spelling ability of pupils and students which then positively correlates to increased reading proficiency and eventually reading comprehension (Treiman, 2018, Schalagal, 2002). In this finding, it was established that spelling activities like drill technique and supplementary learning materials like pop art books, when acclimatized in the classroom and outside class hours and become a routine can enhance the spelling abilities of learners.

While the oral spelling ability of the participating pupils has improved based on the findings, on the sidenote, this result has other implications. Because the participants in the study were from a public school, their English spelling performance was considerably lower than those from the private school. As discussed by Kahn-Horwitz et al. (2006) and Sicam and Lucas (2016), preference and positive attitude towards English are higher in learners from middle and high socio-economic backgrounds which included those enrolled in private schools than in students from lower-socio-economic families and are studying in government-owned academic institutions. This has been a challenge long confronted by the basic education in the country that needs to be addressed as English along with its main components is significant as a language for communication in the context of globalization (Madrunio et al., 2016).

Table 3

Oral Spelling Ability of Grade 2 Pupils after the Drill and Pop Art Intervention

Criteria	N	Frequency (f)				Mean	Verbal Description
		AO (4)	SO (3)	RO (2)	NO (1)		
1. Number of English words spelled correctly	20	14	4	2	0	3.60	Always Observed
2. Time consumed in spelling activity	20	14	3	3	0	3.55	Always Observed
3. Attention given towards live spelling activity	20	16	3	1	0	3.75	Always Observed
Grand Mean	20	44	10	6	0	**3.63**	**Always Observed**

Always Observed (AO) (3.40-4.00); Sometimes Observed (SO) (2.60-3.39); Rarely Observed (RO) (1.80-2.59), and Not Observed (NO) (1.00-1.79).

Spelling Ability Improvement in Written Form

From the results presented in Table 4, it was observed that at some point during the operation of the teaching intervention, there was a marked change in the level of development of the spelling skills through writing drills of the participants. From the verbal description of *Rarely Observed (RO)* (M=2.05) (f=17 as rarely observed) before applying the intervention in the class to *Sometimes Observed (SO)* (M=3.30) (f=14 as sometimes observed) after the last written spelling drill was conducted.

It should be noted here that the words asked by the teachers during the written spelling drill were mostly taken from the words found in the pop art book developed by the researchers. Parents before the beginning of the action research were instructed to read the *Let's Enhance Your English Spelling Ability* to their children at nighttime and/or on weekends, and whenever they have free time at home. Another point to note here was that some participants of the study brought their pop art books to school and read them during lunchtime.

Table 4

Comparison of the Written Spelling Ability of the Grade 2 Pupils as Intervened by the Drill and Pop Art Book

Written Spelling Drill	Mean Score (Total Item=10)	Frequency (f)				Mean Rating	Verbal Description
		Always Observed (4)	Sometimes Observed (3)	Rarely Observed (2)	Not Observed (1)		
Before	2.05	0	2	17	1	2.05	Rarely Observed
During	3.60	0	12	8	0	2.60	Sometimes Observed
After	6.00	6	14	0	0	3.30	Sometimes Observed

Always Observed (AO) (3.40-4.00); Sometimes Observed (SO) (2.60-3.39); Rarely Observed (RO) (1.80-2.59), and Not Observed (NO) (1.00-1.79).

The researchers proposed two potential major reasons for this improved written spelling skill of the participants. First, the knowledge growth that budded from their exposure to the pop art book. As instituted in early studies (Sulzby, 1985; Teale & Sulzby, 1986; West et al., 1993), children's books particularly picture and illustration-filled could offer an incentive for the development of knowledge about print, letters, and sounds in pre-conventional readers (children under the age of nine years old), because storybook illustrations are mostly accompanied by the written text that parents can read aloud to their children. In addition, children may learn more new words during reading than during other exchanges with language, such as during meals and playtime, because children's books contain three times as many low-frequency and basic words as television shows or adults' conversations with children (Hayes & Ahrens, 1988).

The second potential reason is the repetition and practice of phonological awareness. The repeated reading approach utilized in the pop art book given to the participants provided scaffolding for

the students to understand the sound structure of the language and subdivide and segment words into phonemes. This was pointed out by Jongejan et al. (2007) as they described phonological awareness to strongly influencing reading and spelling development. This is because phonological awareness refers to the ability to understand the sound structure and includes the ability to segment speech into phonemes and the aptitude to detect and manipulate phonemes. Hence, repeated reading of the content of the pop art books aided the grade 2 pupils to enhance their phonological awareness to better understand letter sounds which in turn helped them connect sounds to read a word and spell them correctly.

Taguchi et al. (2016) noted that repeated reading could facilitate enhanced reading proficiency, comprehension, and spelling ability. They further claimed that while learners' comprehension increased through the repetitions, they could change their rate of reading as they wished or needed. Crucially, in terms of spelling, children become better spellers as they gain familiarity with the words in the content they read. They eventually spent less time gripping on words, made fewer fixations per word, and return to the previously fixated parts of the text increasingly fewer times. This notion was supported by the statements from the parents during the interviews stating that they observed their children recalled words if they see them once or twice and then they became quick in spelling the words they learn over time.

Significant Spelling Skill Progress

A written spelling pre and post-test was conducted before and after executing the drill and pop art intervention. On their pre-tests, the pupils acquired an average score of 4.55 from a 20-item assessment while on the post-test the score had a palpable increase of 15.70 on average. The increase was reported to be statistically significant (Table 5) with post-test scores (M=15.70, SD=0.48) significantly higher than the pre-test (M=4.55, SD=0.52); t (-24.84), p=0.001.

Table 5

Mean Score Difference in the Pre-test and Post-test of the Grade 2 Pupils

Assessment	Mean Score (Mean±SD)	Standard Error	Significance (p<0.05)	T value	Paired Samples Correlation (R)
Pre-test	4.55±2.33	0.52	0.001	-24.84	0.60
Post-test	15.70±2.15	0.48	0.001		

The observed results in the present study showed that the synergistic influence of the drill and pop art book significantly improved the spelling ability of the pupils. From a developmental perspective, as the researchers proposed earlier that the pop art exposure and repetition reading leading to phonological awareness have potentially brought improvement of the spelling skills of the pupils, these processes thereby suggest that the phonological awareness and visual modeling (i.e. picture books, mechanical books) hold predictive powers in not just the spelling but reading ability of pre-conventional readers. A number of studies have also offered the same propositions in the early reading development of children (Ashmore et al., 2002; Mol & Bus, 2011; Taguchi et al., 2016). However, the central role of phonological awareness and visual modeling in the acquisition of reading and spelling ability can be argued linguistically as there are also other considerable factors at play including the pre-existing reading ability of the individual, literacy exposure, and the language itself.

Themes Generated from the Parents' Feedback

Using thematic analysis, the responses and feedback of the parents during the interviews were segregated into themes as displayed in Table 6. Four questions were asked to the randomly selected parents. The parents were allowed to respond freely. Their responses were analyzed thematically. Main themes and sub-themes were generated to organize clearly the parents' feedback. Seven main themes and thirteen sub-themes emerged from the parents' feedback and comments.

Table 6

Parents' Feedback on the Utilization of Pop Art Book as Supplementary Learning Material in Spelling Skill Improvement

Question	Main Theme	Sub-theme	Description
How did your child find the design and content of the pop art book?	Physical Appeal	Colorfulness, Simple Design, Illustrative/Visual,	The pop-art book catches the attention of the pupils because it is colorful, easy to use, and filled with pictures/images
	Type of Content	Engaging exercises, Entertaining illustrations, Common Examples	The pop-art book is entertaining as it contains familiar examples and exercises suitable for children
Did you notice any spelling interest in your child while you are teaching him/her the contents of the pop art book?	Enjoyment	Positive/Happy Mood in Using the Book	The pupils are happy every time they read the pop-art book
	Frequent Browsing of the Book	Repeated Use of the Book and its Exercises, Memorization of the Words in the Book	The pupils read the pop-art book repeatedly and answer the exercises to memorize the words
How was your child's spelling ability after using the pop art book?	Improved Spelling Ability	Better word recognition, Improved sound recognition and pattern	The pupils can correctly spell basic sight words and become familiar with them that they can use to properly construct a simple sentence.
	Increased Vocabulary	Simple sentence construction	
Will you recommend this pop art book to other parents of elementary pupils?	Ease of Use for Beginners/Early Graders	Sense of enjoyment while learning Alternative to smart devices	The book is recommended since it is easy to use and the pupils enjoy using it, and also a good replacement for smart devices.

Main Theme 1: Physical Appeal and Type of Content

The physical appearance of the book was given emphasis and scrutinized based on its design, colorfulness, and illustrations. On the other hand, the content of the book was described to be entertaining due to its illustrations and common examples. Some comments were:

P#1

> "Yes, my daughter liked it. She was really happy with the 3D pictures that stood up when the book was opened. She liked the book because the book is really well-made for children, and the design is suitable for their age. This is a type of book that is not scary or boring for children. Most children today when they see a book they suddenly cry or run away. This pop art book is enjoyable like story books or coloring books, this gets their attention."

P#3

> "I saw that he enjoys using it, especially on the part where there are pop art pictures. He can also relate to the objects in the pictures because he is familiar with them."

From the views of the parents which were based on their observations of their children, the exterior and overall design of the pop art book could be a factor to pick the interest of their children when it comes to selecting a reading material. Visual information is the most vital form of information for our brains. The human brain can process an image in mere 13 milliseconds (Potter et al., 2013) and thus, it is not surprising that more or less 90% of the information transmitted to the brain is visual. Colors, simple shapes, geometric patterns, cartoonized pictures, arrows, and positions translate unrelated text into a board, which the brain has a chance of examining in a non-linear way. Visual depictions give our brains more freedom in choosing what to focus on. Regardless of age and experiences, the mind is neurologically sensitive to colors and shapes more than to text (Clerkin et al., 2016).

Main Theme 2: Enjoyment and Frequent Browsing of the Book

Enjoyment and frequency of browsing the book were the indicatives of the interests of the children in the pop art book. Responses from the parents include:

P#6

> "Every time I tutor my daughter using the pop-up, I feel that she could easily memorize the words because there is a picture that represents it. She liked that the images are things we use every day."

P#4

> "My child finds it easy to answer the exercises in the pop art book because he already memorized the words and pictures inside the book. He reads it even if I am not teaching him."

The influence of emotions such as enjoyment and happiness have a positive effect on learning, memory, and social behavior (Hernik & Jaworska, 2018). As their study put it, enjoyment is regarded as a positive impression due to positive stimuli and is an essential element of a balanced life. This is

extremely important because a sense of harmony equates to feeling safe, feeling at ease, and feeling valued which in turn is an indispensable factor in both group and individual learning. Consequently, this sense of enjoyment prompted the young learners to use the book more and encounter the words more frequently eventually enriching their vocabulary and spelling ability.

Main Theme 3: Improved Spelling Ability Increased Vocabulary

All of the parents stated that the spelling ability of their children improved since they started using the pop art book as supplementary reading material at home. Meanwhile, the parents also rationalized that they will recommend the book because of the enjoyment, the ease of use, and the pop art being a good replacement for gadgets in terms of learning activity and pastime.

P#1

> "The book helped my daughter a lot because after we started practicing spelling, she can now recognize the sound of each letter. As time goes by, she also becomes good at spelling. It was also a big help because now it's easier for me to teach her how to read."

P#5

> "The book did a great improvement on my child's spelling ability because before he doesn't want to do spelling. He hates spelling. But he had a change of mind and now he wants to always spell with me like it is a game."

P#7

> "There's an improvement in his spelling ability. He can now spell words that he can't before. Before, he can't spell the words in his book even after we studied it several times. Now after studying the pop-up and we closed the book, when I ask him to spell some words, he spelled them correctly, easily."

The use of pop art and drill had driven important behavior and cognitive mechanisms which ultimately led to improved spelling and increased vocabulary of the early-grade learners. As mentioned earlier, phonological awareness and visual modeling such as pop-ups and mechanical books hold predictive powers in the spelling and the reading ability of pre-conventional readers. Blunsdon et al. (2003) supported the present result when they investigated the use of frequent drills and linked it to sense of enjoyment and its potential learning outcomes. It was revealed that students "thought" they have learned more and can apply what they have learned if they "enjoyed" the experience and they are more likely to "continue doing" the activity due to the satisfaction and perceived knowledge gain the experience is providing.

Main Theme 4: Ease of Use for Beginners/Early Graders

The ease of use pertaining to the simplicity and practicality of the pop-up book is what primarily prompted the parents to recommend the book to early graders. As agreed in the early developmental process (Clerkin et al., 2016; Yu & Smith, 2012) children are most likely to learn the basic words in their early years which these words may have been the objects that are visually frequent in their households, though it is to be noted that it is not always the case. Nevertheless, the present study proved that pop-

up books containing simple and commonly encountered objects with their equivalent term and correct spelling helped the learners improve their spelling.

In summary, positive feedback from the parents were collated which affirmed the effectiveness of the pop art book in the enhancement of the pupils to spell basic English words. However, the present findings may still be pursued in other settings and should proceed with further validation using a large sample size.

Conclusion

The study's findings demonstrated the collaborative influence of drill and pop art in the significant spelling ability improvement of grade two pupils. The underlying perspective was that young learners may enhance their literacy skills and their subskills like spelling and reading through the repeated reading approach leading to phonological awareness and evoking visual stimuli. While these may be perceived as the predictors of spelling and reading proficiency, further studies particularly longitudinal studies have to be established for more concrete evidences. To the knowledge of the researchers, this is the first local study that combined drill and pop art in the enhancement of elementary English with a focus on spelling ability.

Likewise, this outcome strengthens the stage theory of spelling development in which learners evolve from preliterate to alphabetic spellers as they master the letter-sound correspondence and become able to spell complex syllable patterns and derivational patterns. On the other hand, as the learners become more phonologically aware through the use of various intervention materials inside the classroom, there are direct and indirect mechanisms of phonological and morphological awareness development that affect not only the vocabulary and reading ability of the learners but their language proficiency in general.

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Determinants of Loan Application and Level of Satisfaction of Farmer-Borrowers of Different Lending Institutions in the Fourth District of Nueva Ecija

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Abstract

This study aimed to identify the determinants of loan application of farmers and their satisfaction level on the different lending institutions in fourth District of Nueva Ecija. Out of eight Municipality, seven Municipality were included in the farmers interview, from 736 total population, 259 respondents were selected using slovins formula. Respondents was come from three lending institution namely; Land Bank of the Philippines, Rural Bank of San Leonardo, and Tulay sa Pag-unlad Inc. The respondents were selected based on their socio demographic characteristics that would fall on the interest of the study, farmer respondents were identified based the data from the Office of the Municipal Agriculturist of the Fourth District of Nueva Ecija. Socio-demographic characteristics of the farmer respondents were significant to their level of satisfaction, wherein demographic characteristics affects the decision of the borrower in availing for loan. The better the demographic characteristics of the borrower the more satisfied they are on the loan programs offered by their respective lending institution in addition the more acceptable the determinants the higher the satisfaction of the borrower. Relationship of determinants and levels of satisfaction shows that, there is significant relationship between loan determinants and level of satisfaction. There is strong positive correlation between the two variables wherein the loan determinants were more acceptable, the level of satisfaction increases. Likewise, the higher the acceptance of determinants of loan application the higher the levels of satisfaction of the respondents.

Keywords: *satisfaction, determinants, loan availment, relationship*

*Municipal Agricultural Office, LGU-San Leonardo, Nueva Ecija
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Introduction

Nueva Ecija was also known as the rice granary of the Philippines in which most of the farmers especially the poor ones were relying on agricultural loan as the major source of their capital. Accessing credit or granting loans was such a great help to the farmers of this province. Agricultural loan supports farmers by providing money, allowing them to use funds to acquire inputs. According to Dasharath (2016) agricultural loan enhances productivity and promotes standard of living by breaking vicious cycle of poverty of small-scale farmers. Rural financial market in the Philippines consists of formal credit institutions and informal credit channels.

Source of capital was among the most common problems faced in agriculture particularly in rice farming, small farmers usually borrowed money for the source of their capital, World Bank (2007) claimed that financial constraints are more prevalent in agriculture than in other sectors. Access to credit has been considered as one of the main problems that farmers have to deal with in order to survive. Nithin (2016) stated that credit was one of the critical inputs for agricultural development it capitalizes farmers to undertake new investments and/or adopt new technologies. Borrowing money from informal sources causes small farmers from indebtedness due to its high interest rate of 10% per month or sometimes informal lenders demand rice as an interest to the borrowed capital (Nagarajan and Meyer 1993), unlike to the formal sources like government and private banks that offers lower interest rate of around 2% per annum.

Stiglitz and Weiss (1981) reasoned out that small farmers who may be good credit risks are unable to acquire credit from formal channels and resort to borrowing from informal sources. Another problem was formal channels requires collateral for loan to ensure that farmers will pay for his/her borrowed capital, (Bester, 1985; Chan and Kanatas, 1985; Besanko and Thakor, 1987) explained that collateral requirements were common terms in loan contracts, together with the interest rate, maturity, and size and possible covenants. Credit market research explains the use of collateral as a consequence of adverse selection and/or moral hazard (Boot et al., 1991), which problems arise in transactions between borrowers and lenders.

Nueva Ecija have three (3) common lending institutions offering loans to the farmers, these are; Government Banks, Rural Banks, and Private commercial institution such as Land Bank of the Philippines (LBP), New Rural Bank of San Leonardo and Tulay Sa Pag unlad Incorporated (TSPI). Each lending institution have different guidelines or protocols in granting farmers for loan and also have different interest rate on loans. This paper will seek to determine the impact of the lending institutions to farmers by determining interest rate offered by different institutions, benefits offered and also the collateral needed in availing loans. In addition, this paper would explicit the negative thinking of the borrowers regarding on the policy and guidelines on granting loans by different lending institution.

This paper aims to: determine the credit profile of borrower in terms of; number of years as borrower, type of lending institution, loan program availed, interest rate availed and collateral; identify the determinants of loan application and availment to the lending institution such as: interest rate free insurance, collateral, easy application: 4. identify the problems encountered by the farmer- borrower in terms of: application, releasing, payment. And to assess the level of satisfaction of farmer borrowers on the services of the different lending institutions such as: lowest interest rate, insurance and timely release of loans.

Materials and Methods

Correlational, and descriptive research design using survey method was used in this paper wherein the data collected contain independent-dependent variables which describes the interrelation of the different factors affecting the loan accessibility of farmer borrower. Using Cochran's formula, 259 respondents was selected in which One Hundred Thirteen (113) respondents came from Land Bank of the Philippines, ninety-two (92) came from New Rural Bank of San Leonardo, and Fifty-Four (54) respondents came from Tulay sa Pag-Unlad Inc. from the total population of 736 farmer borrower from 4th District of Nueva Ecija.

Test of means and standard deviation was used to determine the personal, social and entrepreneurial characteristics, role of the linkage of the different institutions and problems faced by the farmer borrower also Pearson's Product Moment Correlation (Pearson's r) was used to determine the relationship between respondents' age, household size and years of farming experience, number of years as borrower, characteristics of farmer borrower, role of different linkages, problems faced by the farmer borrower. In determining the relationship between the educational attainment, loan program and interest rate availed, analysis of variance (ANOVA) was used.

Results and Discussion

Socio Demographic Characteristics

Socio-demographic characteristics of farmer borrowers was investigated by the researcher in terms of sex, education, job, source of income. Results shows that most of the borrower were; male (freq = 180; % = 69.5), High School Graduate (freq = 117; % = 45.2), farmer as their occupation (freq = 259; % = 100), and Farming as their source of income (freq = 258; % = 99.6) Table 1.

Table 1

Socio-Demographic Characteristics of Respondents

Indicators	Frequency	Percentage
Sex		
Male	180	69.5
Female	79	30.5
Educational Attainment		
Elementary Level	4	1.5
Elementary Graduate	27	10.4
High School Level	51	19.7
High School Graduate	117	45.2
College Level	38	14.7
College Graduate	19	7.3
Others (Vocational)	3	1.2
Occupation		
Farmer	259	100
Source of Income		
Farming	258	99.6
Tricycle	1	0.4

According to Nguyen (2007). Socio demographics factors affect the bank choices of the products. In order to properly evaluate bank product performance a business must know the demographic profile of its customers. To see if the demographic traits necessary to support the performance of the business, it must look at the customer: purchasing power, and the degree of disposable income within the various demographic categories.

Determinants of Loan Application and Availment to the Lending Institution

The results on the determinants of loan, show that respondents *always* consider loan application process prior to loan availment (mean = 4.55; SD = 0.56), and interest rate (mean = 4.34; SD = 0.72), insurance was *often* considered by the respondents (mean = 3.92; SD = 1.10) while collateral was *sometimes* considered by the respondents prior to loan availment (Table 2). As respondents thinking was to minimize their resources by accessing credit that would fit their socio demographics, needs and minimize their hours in applying and availing of loans.

Table 2

Determinants of Loan Application

Item	Mean	SD	Verbal Description
Interest rate	4.34	0.72	Always
Insurance	3.92	1.10	Often
Collateral	3.19	1.26	Sometimes
Application	4.55	0.56	Always

Results on the problems encountered (Table 3). Shows that respondents *disagree;* on the application process (mean = 2.35; SD = 1.41), and loan releasing (mean = 1.82; SD = 0.73) Moreover, respondents *strongly disagree* that they have encountered problems in loan repayment (mean = 1.74; SD = 0.86).

Table 3

Problems Encountered

Item	Mean	SD	Verbal Description
Application	2.35	1.41	Disagree
Releasing	1.82	0.73	Disagree
Repayment	1.74	0.86	Strongly Disagree

Levels of Satisfaction of Farmer Borrower

Farmer borrowers were *very satisfied* on the determinants of loan application as perceived by; interest rate (mean = 4.26; SD = 0.81), application process (mean = 4.36; SD = 0.64), farmers were *satisfied* on the insurance offered by lending institution (mean = 3.67; SD = 1.48) while some were *Neither Satisfied nor Dissatisfied* on the required collateral by lending institution (mean = 2.74; SD = 1.16) Table 4.

Table 4

Levels of Satisfaction of Farmer Borrower

Item	Mean	SD	Verbal Description
Interest Rate	4.26	0.81	Very Satisfied
Application	4.36	0.64	Very Satisfied
Insurance	3.67	1.48	Satisfied
Collateral	2.74	1.16	Neither Satisfied nor Dissatisfied

Relationship between the Respondents' Sociodemographic Characteristics and Their Level of Satisfaction on the Different Lending Institution

Table below shows that, there was a *highly significant* relationship occurred between collateral and level of satisfaction among respondents that was less than 0.01 level of significance with a of p-value = 0.000. Results shows that there was a low positive correlation between collateral and satisfaction at R value of 0.479. This shows that the higher the value of collateral the higher the satisfaction of the respondents, this explains that amount to be loaned was based on the collateral presented by the respondents, the bigger the collateral value the higher the loanable amount also, the more secure the loan. *Significant* relationship was also observed between problems encountered and level of satisfaction (p-value = 0.034). Results shows that, as the borrower experience less problems, the level of satisfaction increases. Moreover, *significant* relationship was also observed between insurance and level of satisfaction (p-value = 0.000). There was strong positive correlation (R=0.872) between the two variables. Crop and accident insurance influence the availment of loan among respondents wherein farmers always seek for the security of their self and for their crop planted against external factors that may affect or influence reduction of their harvest.

Table 5

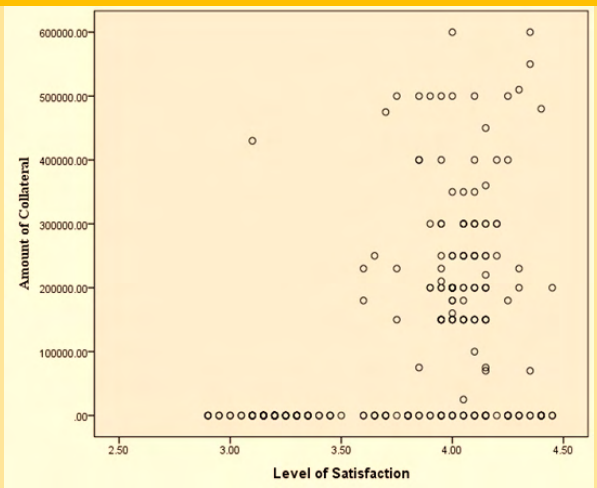
Relationship of Independent Variables on the Levels of Satisfaction

Variable	Mean	SD	R-Value	R Square	p-value	Result
Amount of Collateral	113, 050.19	152, 357.32	.479[a]	0.229	.000[b]	Significant at 0.01
Level of Satisfaction	3.76	0.44				
Problems Encountered	1.96	0.53	.132[a]	0.017	.034[b]	Significant at 0.05
Insurance	3.92	1.04	.872[a]	0.759	.000[b]	Significant at 0.01

Figure below shows the relationship between amount of collateral and levels of satisfaction (Figure 1). This shows that the highest amount of collateral was at 600,000.00 pesos with levels of satisfaction from 3.9 to 4.5. Most of the respondents' collateral ranged from 70,000.00 to 550,000.00 pesos. It was observed that the higher the collateral the higher the levels of satisfaction. While on the other side some respondents were 0 values on collateral with level of satisfaction ranging from 2.8 to 4.5, which means that the farmers with 0 collateral has no collateral gave to their selected creditors.

Figure 1

Relationship of Amount of Collateral and Level of Satisfaction



Test for Multicollinearity

Table below shows the test for multicollinearity. Results shows that there were no signs of multicollinearity within the independent variables because the variance inflation factor (VIF) were less than 5. Multiple regression was run to predict the level of satisfaction from loan determinants such as application, insurance, collateral as well as problems encountered, amount of collateral and number of years as borrower. The results show that the combination of insurance and collateral policies contributes to the increase of level of satisfaction of borrowers.

Table 6

Results on Multiple Linear Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.933	.224		8.618	.000
Application	.037	.039	.031	.948	.344
Insurance	.357	.017	.846	21.102	.000
Collateral	.082	.029	.101	2.788	.006
Problems Encountered	.006	.028	.008	.233	.816
Amount of Collateral	2.069E-7	.000	.072	1.837	.067
Number of Years as Borrower	-.006	.004	-.048	-1.416	.158

Dependent Variable: Level of Satisfaction

Conclusions

Based on the results of this study, the more acceptable the determinants of loan; the higher amount of collateral; and the less problems encountered; the higher the satisfaction of the farmer-borrowers. Also, shows that among the determinants of loan application, farmer-borrowers tend to have higher satisfaction on the application process. Moreover, the better the socio-demographic and credit profile, the higher the satisfaction of the farmer-borrowers.

Recommendations

Based on the results of the study, the following are some recommendations that could benefit farmers:

1. The lending institution in partnership with the Local Government Unit may conduct seminar on the process and benefits applying loan to the formal institution.

2. Lending institutions my provide loan program that requires minimal documents that are easy to provide.

3. The lending institution through national agencies offer loan in higher amount that would not require material assets/properties as collateral such as stated in this study, instead require collateral that are easy to provide such as human collateral or guarantor.

4. The lending institution in partnership with Local Government Unit bring closer the credit to the farmers especially in the Barangays that are far from the credit facilities.

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The **Southeast Asian Journal of Agriculture and Allied Sciences (SAJAAS)** is the new research journal of Bulacan Agricultural State College. This journal will be an international double-blind peer-reviewed journal, with plans for open access and international indexing.

1. The article should be typed on an A4 size bond paper, with 1 inch margins on top, right, and bottom, and 1.5 inch on the left. The text should be in Arial font size 11 with 1.5 line spacing. The article should not exceed 16 pages and 6000 word limit, including the abstract, figures, tables, and references.

2. The **cover page** contains the title of the article and the name, affiliation, address and email of the author/s. The **name of the author/s or their affiliations** shall not be indicated anywhere in the body of the paper.

3. The second page contains the **abstract**. It should be a paragraph that concisely informs the reader about the topic, methods and main findings. It must contain up to 250 words only and must not contain undefined abbreviations. Below the abstract are the list of up to five keywords about the paper, to be used for indexing purposes. The abstract page should only contain the title, abstract and keywords.

4. The body of the article should contain the following sections:

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- The **Results and Discussion** section should present a solution to the problem stated in the introduction. Subsections should make reading easier. If tables and figures are used to visually show the results, only the critical data should be restated in the text to emphasize evidence on which the conclusions are based. The data should also be interpreted in this section. Conclusions and recommendations are also stated in this part.

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