



## Awareness and Compliance of Corn Farmers to Good Agricultural Practices (GAPs) in Nueva Vizcaya, Philippines

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**Abstract** This study investigated the level of awareness and extent of compliance to certification of corn farmers with Good Agricultural Practices (GAPs) in corn development projects in the cluster municipalities of Nueva Vizcaya. The study sought to determine the demographic characteristics of the respondents, their level of awareness in GAP corn certification requirements, and extent of compliance in GAP corn certification. One hundred sixty (160) corn farmers who are active participant in GAP corn project were randomly selected. Descriptive statistics such as frequency counts, percentages, and mean were used in describing the demographic characteristics of the respondents. A four-point Likert-type scale was used to analyze the level of awareness and extent of compliance. The result revealed that both men and women are active corn farmers, older farmers, most have formal education, smallholder farms, more experience in farming and members in farmers' organization and cooperatives. Likewise, the study indicated a high awareness of the respondents in GAP corn certification requirements gained through their participation to various GAP and GAP-related trainings and activities while compliance to GAP certification is moderate which resulted to low certified corn farms in Nueva Vizcaya. Demographic profile such as sex, education and trainings have positive correlation to the respondents' awareness, however, there is no significant correlation to their compliance.

**Keywords** GAP, awareness, compliance, certification requirements

### INTRODUCTION

Good Agricultural Practices (GAP) certification is a stamp of safety and genuine freshness (ATI, 2013). The Philippine GAP program is a government certification program with the Department of Agriculture as the certifying body. The enactment of Republic Act No. 10611 otherwise known as "Food Safety Act of 2013" strengthens the food safety regulatory system in the country (Official Gazette of the Philippines, 2013). The GAP standard requires a scrutiny of the history of the farm site and its prior; the type of soil, and its compatibility with crops and seed sources; the judicious use of agrichemicals; the sources of potable water for irrigation and washing of crops; the harvest and post-handling procedures; the health and hygiene of the farmer and handlers, and other factors. Aside from scrutiny, the GAP standard also requires systems to be set in place such as sanitary facilities, safe storage areas, post-harvest infrastructure, a paper trail for traceability, among others (PNS, 2017). The Code of GAP for corn is a set of consolidated safety and quality standards prepared by the Department of Agriculture for the production, harvesting and on-farm postharvest handling and storage of corn. The emphasis is to decrease the hazard of pesticide use and aflatoxin contamination. GAP corn was officially launched in 2014, and it became more intensive since the passing of RA 10611 due to inappropriate use of pesticides and other chemicals in farming that pose a hazard to both human and animal health.

The national trend of low GAP adoption is reflected in the Province of Nueva Vizcaya in the Northern part of the Philippines. That despite its intensive implementation and government support, the adoption and certification for GAP corn is still very low, a measly 1.78% in the corn cluster areas, hence, this study investigated the awareness and extent of compliance of corn farmers to

Good Agricultural Practices (GAP) which is a prerequisite to adoption and certification. The purpose is to identify the requirements with low compliance as basis of the implementers for planning. Likewise, it will be relevant to the corn farmers to appreciate good agricultural practices in general and the GAP corn in particular and for them to realize the requirements they have complied and those that needs to be improved. The eight requirements for GAP corn certification were evaluated that included: farm location, farm environment, farm structure and facility maintenance, pre-harvesting practices, harvesting practices, post-harvesting practices, safety and precautions, and farm management.

## **OBJECTIVES**

This study aimed to determine the demographic profile of the respondents, the level of the respondents' awareness in GAP corn certification requirements, and the extent of compliance in GAP corn certification.

## **METHODOLOGY**

The study was conducted in 2019 in the four corn cluster municipalities (Bagabag, Diadi, Quezon and Villaverde) of Nueva Vizcaya. Simple random sampling was used to identify the 160 respondents. Descriptive statistics such as frequency counts, mean, and percentages was used in describing the demographic characteristics of the respondents. A four-point Likert-type scale was used to analyze the level of awareness and extent of compliance. Pearson's *r* was used in measuring the significant relationships between the variables in the study.

Instruments for data collection included: survey questionnaires and key informants' interview of Farmer Led Extensionists (FLEs) and Agricultural Extension Workers (AEWs). The structured survey questionnaire included open-ended and categorized questions.

## **RESULTS AND DISCUSSION**

### **Demographic Characteristics of Corn Farmers**

The result revealed that 50% are male and 50% are female. It can be noted that more females are now involved in corn farming and in the agricultural industry as a whole. The mean age is 52 years old, the youngest is 25 years old and the oldest is 80 years old. It can be deduced that there are older corn farmers because younger people nowadays prefer nonfarm careers. In the Cagayan Valley Region, the average age of corn farmers is 51 years old (PSA, 2014).

The study shows that the respondents are mostly high school level or graduates with 51.90%, college (25.1%) and vocational/technical education (5.6%). It can be inferred that the corn farmers are better educated when compared to the provincial statistics wherein high school is 35.75%, college (19.40%) and vocational (3.40%) (PSA, 2014), in effect they are more open in adopting new technologies and practices in farming. They also understand the consequences of conforming to sustainable agricultural practices for land-use and production efficiency, global warming potential, economic viability, conservation of biodiversity, waste minimization and recycling, farmer and community well-being, animal welfare, and the capacity to meet food sufficiency long into the future. Education also allows a farmer to share his farming experiences to other farmers.

The average area farmed is 1.93 hectares, majority (58.2%) of the corn farmers surveyed have 1.0 - 2.9 hectares. The result signifies that the size of cultivated land and average land productivity could strongly affect farm revenues and, consequently, investments. This explains the ability of farmers to diversify in farming, smaller land area tends to lean more on monocropping which is discouraged in GAP since it proliferates pests and diseases and depletes soil fertility while larger farmlands could diversify not only as an approach to prevent pests/diseases and soil fertility

depletion but to increase revenue as well. The increase in revenues enable the farmers to establish the needed facilities and structures in GAP farming.

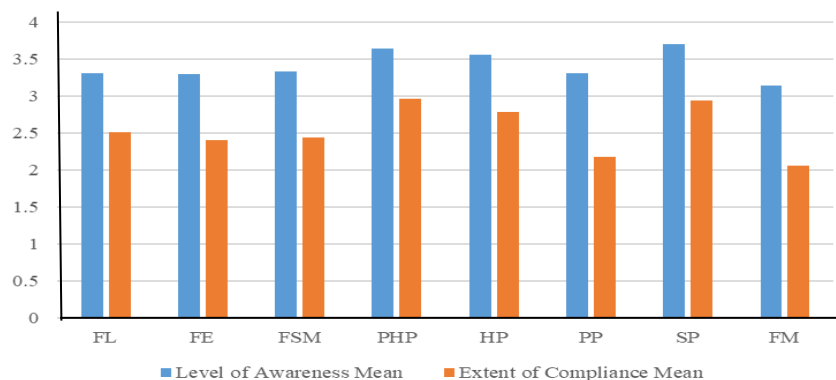
The average number of years in corn farming is 20. Most respondents had 10-29 years (56.5%) experience in corn farming, 24.5% had more than 30 years and 19.5% with less than 10 years. The respondents' minimum number of years in corn farming is 5 and the maximum is 60 years of experience. It can be noted that the respondents are experienced corn farmers. Extensive experience in corn farming helps the farmers to determine the merits of adopting new technologies based on their knowledge gained through years of corn farming. This aided them in decision-making for adopting GAP, in addition it boosts their confidence to share their experiences and facilitate the spread of new technologies like GAP. This is consistent with the national and regional statistics wherein (BAS, 2011) reported that corn farmers in the country had an average of 22 years of farming experience.

More than eighty percent (86.7%) are members of farmers' organization, cooperatives with 65.6% and other organizations with 54.4%. Membership to farmers' organizations, cooperatives and other organizations in the community help the farmers to unify their efforts towards achievement of their common goals especially in lobbying for government and other agencies' support and services in training, facilities and machineries, loans and other agricultural assistance. Cooperatives is the government vehicle in granting farmers loans. It also extended seed, fertilizer and agrichemical loans with agreeable payment schemes. It is through these organizations that small farmers band together to convey issues and concerns through their representatives (e.g., Municipal Agricultural and Fishery Council) and avail of assistance.

Respondents' participation to GAP-related trainings such as integrated pest management (IPM) like proper spraying and disposal of used herbicides, how to make organic pesticides from fruit and plant juices, pest surveillance, etc. has high attendance with 96.3%, followed by integrated crop management with 74.4% and other trainings with 38.1%. These related trainings support the implementation of GAP by reinforcing it through activities and demo farms. It will also increase the farmers' self-reliance and confidence in adopting GAP by expounding their training to encompass technologies that is important in sustainable agriculture. These practices help to improve environmental and ecological diversity as well as economic condition towards GAP adoption.

### Awareness and Compliance in GAP Corn

Fig. 1 illustrates the comparison of means for the respondents' level of awareness and extent of compliance for the eight GAP corn requirements.



*FL – Farm location, FE – Farm environment, FSM – Farm structure and maintenance, PHP – Pre-harvesting practices, HP – Harvesting practices, PP – Post-harvest practices, SP – Safety and precaution, FM – Farm management*

**Fig. 1 Comparison of means for the respondents' level of awareness and extent of compliance to GAP corn**

Farm location has high awareness denoted by an average mean of 3.31 on the suitability of the production area and its surrounding farms for agricultural use. They have to trace the history of the land use whether it is being used for other purposes other than agriculture such as landfill to identify possible potential hazards specifically chemical (heavy metals) and physical hazards (broken glass, plastics, rubber, etc.) as part of the requirement. However, the respondents are moderately aware on how to identify ways to prevent the potential hazards. The result implies that the respondents are highly aware of the requirements and fully understood the importance of tracing the history and land use pattern of their farm. These requirements were thoroughly discussed during the GAP training conducted by the Agricultural Training Institute (ATI), Department of Agriculture (DA) and Local Government Units (LGUs). Compliance is moderate with an average mean of 2.51 for farm location since all of the corn farms were established not for other purposes but for crop production only and the potential hazards identified is the excessive use of agrichemicals and natural calamities such as flooding and drought. The slight compliance for mitigating measures is attributed to their lack of documentation or records concerning the potential hazards in their farms.

Respondents' awareness on farm environment was high with an average mean of 3.30. The respondents were highly aware that the production area, post-harvest and storage area should be kept clean at all times to avoid contamination. Likewise with the importance of crop rotation to avoid soil deterioration due to monocropping especially planting of nutrient enriching plants like peas, peanuts, beans and other leguminous crops and availability of water source or irrigation to avoid plant stress. It is only soil analysis that has moderate awareness, this might be due to absence of soil laboratory in the province to cater the needs of the corn farmers. The farmers have to submit soil samples through the LGUs to be brought to the soil laboratory at the neighboring provinces in Isabela or Cagayan. The respondents stated that the release of the soil analysis result as basis for fertilizer application was delayed wherein the crops was already harvested but the result is not released yet. The AEWs also encourage the use of convergence approach such as integrated farming for the integration of other crops and livestock in corn farming as alternative source of income. The compliance for farm environment is slight with an average mean of 2.40 for field sanitation practices, soil nutrient status analysis for appropriate fertilizer recommendation, soil mapping for crop rotation and production plans and locating water sources. Soil analysis should be done every two years and carried out by accredited laboratory. The slight compliance for certification requirements with regards to farm environment can be attributed to their non-adoption of strict field sanitation practices, soil analysis, and soil mapping.

The respondents were highly aware that farm structures and facilities should be maintained with an average mean of 3.33. Structures such as warehouse for the corn produce, storeroom for fertilizer, pesticide and other farm supplies and materials including protection shed of farm machineries should be appropriately designed and constructed in a reasonable distance from one another to lessen contamination. Likewise, farm structures, facilities and equipment should always be kept clean and in good condition for optimal operations. They were also highly aware that sewage, waste disposal and drainage system should be appropriately located and constructed to minimize the risk of contaminating the production area and water supply with chemical hazards. The farmers claimed that GAP is good since it safeguards health, and the proper storage of agrichemicals such as insecticides, pesticides and fungicides makes it easier to locate when needed. Display of farm code and availability of medicine kit in the farm is moderate. It is imperative that a fully equipped first aid box with all the necessary items is placed prominently in the farm. Farm structure and facility maintenance has slight compliance with an average mean of 2.44. The respondents' reason for slight compliance is the lack of finances to construct farm structures such as storage for tools and machineries though there is no prescribed size for structures as long as it is safe for farm tools and materials and properly labeled. The respondents stressed that they are compliant in GAP especially in farming practices but lack the financial capability to establish the needed structures and toilets required in GAP corn certification that is the reason for non-certification.

The result for the pre-harvest practices has high awareness with an average mean of 3.64 that includes weed control measures through proper land preparation to ensure healthy and uniform

plant growth; planting and seed materials such as use of high yielding varieties that are adaptable to the locality and following the recommended planting distance and seeding rate; proper handling and use of agrichemicals such that applicators should be trained and wear protective gear when handling and spraying, agrichemicals should be properly labeled and stored and proper disposal of empty container, and strict observance of pre-harvest intervals; fertilizer management such as use of fully decomposed organic materials, fertilizer application should be based on soil analysis, proper storage to prevent contamination due to leaching, runoff or wind drift and records of fertilizer sources and application; insect pest and disease management during flowering to maturation stage and prevention of aflatoxin contamination; other cultural management practices such as maintenance of the recommended row and plant spacing to avoid overcrowding and regular monitoring at all crop stages to provide measures to problems that may arise. While compliance is moderate with an average mean of 2.96, the pre-harvesting practice were adequately implemented and complied by the respondents due to their extensive experience in corn production.

Harvesting practices includes harvesting of fully matured corn in the shortest possible time, the use of clean mats and other suitable underlays to prevent damage and contamination of corn ears and remove corn ears that show visible signs of insect or microbial damage. The respondents have high awareness with an average mean of 3.56 but moderately complied with an average mean of 2.78. Following the recommended harvesting practices has high compliance but sorting has slight compliance. Sorting out and discarding corn ears with visible damage is not followed by the respondents because they sell their harvest immediately to buyers upon harvesting.

Post-harvesting practices has high awareness with an average mean of 3.31. This includes hauling should be done immediately after harvest and facilities for hauling should be clean and dry; immediate drying of corn grains to reduce the moisture content; avoid grain moisture accumulation during transport by using an appropriate covering for the container, proper stacking inside the transport vehicle and protection against pests; storing area should have good ventilation, prevent entry of insects, birds and rodents and maintain the recommended moisture content to minimize aflatoxin contamination and conformity to the principle of first-in-first-out. The respondents asserted that though they are aware of the ideal moisture content of the corn to avoid aflatoxin but they do not have the instrument for testing it. Post-harvesting practices has slight compliance with an average mean of 2.18. This might be due to the fact that farmers sell their yellow corn directly upon harvest and no longer follow post-harvesting practices while white corn also referred to as green corn are sold by contract when it is matured for cooking and eating. The key informant revealed that GAP evaluation for certification in post-harvesting is done by testing for aflatoxin which is accomplished by getting 5 kilos sample from the harvested seeds. The dried seeds was brought to the laboratory at DA-Cagayan Valley Integrated Agricultural Laboratory (DA-CVIAL) for the said test.

With regards to safety and precautions, all the variables were rated to have high awareness with an average mean of 3.70. This includes wearing of appropriate clothing and protective gears in production and post production activities and training of farm workers to follow the recommended personal hygiene and sanitary practices. The respondents agreed that safety gears should be worn to avoid exposure to chemical hazards as well as training and supervising farm workers in the proper use of agrichemicals and sanitary procedures. It is a major compliance criterion that pesticide application protective gear must be present in the farm at all times. The equipment must be kept clean and functional, and there must be documentation that shows that farm workers have been trained to use the protective gear correctly. Compliance on safety and precautions was rated to be moderate with an average mean of 2.94. The respondents are moderately compliant with safety and precautions which implies that though they are aware of the consequences of mishandling agrichemicals but some farmers still do not strictly follow the recommended safety and precaution practices.

Respondents has high awareness on farm management with an average mean of 3.14. It includes keeping of farm and staff records and traceability. Farm records should be updated using the DA pro-forma record system of GAP corn and should be kept up to two years. (PNS, 2017) explained that new farm applying for certification must have at least 3 months of farm records which should be presented during audit, hence, someone should be designated as in-charge to deal

with matters associated with GAP corn certification. Likewise with records of farm workers and their trainings should be maintained. The respondents claimed that though there is a pro-forma record system but they also use a simplified record system that they could easily understand. They use record book to log in farm activities with the corresponding expenses like cost of inputs and labor. In traceability, produce leaving the farm must be traceable to the farms, thus records must also be maintained. The respondents insisted that the corn buyers can trace back the produce to their farms since they know their sources or suppliers of corn. Compliance was slight with an average mean of 2.06. Farm records has moderate compliance that includes designating in-charge to deal with matters associated with GAP corn certification like copies of laboratory analysis and certificates that verify compliance with the DA regulations. The respondents claimed that maintaining the pro-forma farm records from DA is complicated and time consuming, hence, they improvised and ask assistance from family members and AEWs in accomplishing the farm records issued by DA. Maintaining of staff records has slight compliance and traceability was low which suggests that the respondents are not compliant with these particular criteria.

The overall mean for GAP corn awareness was denoted by the mean value of 3.42, which is qualitatively described to have 76-100% awareness of the requirements in the GAP corn. While the overall mean on the extent of compliance is indicated by a mean value of 2.54 which is qualitatively described to have 51-75% compliance signifying that awareness is 25% higher than the respondents' compliance.

In the correlation analysis in Table 1, sex, highest educational attainment, and trainings are significantly correlated to the respondents' awareness in farm environment, pre-harvesting and harvesting practices at 5% level of significance. The respondents' awareness in GAP corn in terms of farm environment ( $r = 0.174$ ) and pre-harvesting practices ( $r = 0.176$ ) positively correlated with sex. It indicates that more involvement of both men and women in corn farming spell increased awareness in farm environment that includes cleanliness to avoid contamination, crop rotation, and availability of irrigation; and pre-harvesting practices such as weed control measures, planting and seed materials used, proper use of pesticides and other agrochemicals, fertilizer, insect and pest management and other cultural management practices. The respondents' awareness in terms of farm environment ( $r = 0.157$ ) and pre-harvesting practices ( $r = 0.163$ ) are significantly correlated with the respondents' highest educational attainment. The result signifies that the respondents with higher educational attainment have higher understanding of the environmental effect and pre-harvesting practices in GAP corn. This further implies that the respondents' education is important in their awareness and adoption of GAP corn.

**Table 1 Relationship between the demographic profile and level of awareness in GAP corn**

Demographic profile	Level of awareness in gap corn							
	FL	FE	FSM	PHP	HP	PP	SP	FM
Age	.006	-.046	-.043	-.048	-.045	-.032	-.039	-.039
Sex	.059	.174*	.130	.176*	.151	.134	.143	.143
Highest educational attainment	-.064	.157*	.081	.163*	.117	.076	.096	.096
Land area for corn farming	.083	.097	.096	.097	.097	.097	.097	.097
Number of years in corn farming	.121	.087	.066	.086	.075	.093	.085	.085
Membership in farmer's organization	.021	.022	.008	.022	.015	.018	.017	.017
Membership in cooperatives	.032	.019	.008	.018	.012	.019	.016	.016
GAP trainings	.090	.175	.123	.178	.147	.141	.144	.144
Other trainings	.080	.348**	.203	.354**	.267*	.231	.249	.249

\* Correlation is significant at the 0.05 level (2-tailed), \*\* Correlation is significant at the 0.01 level (2-tailed)

FL – Farm location, FE – Farm environment, FSM – Farm structure and maintenance, PHP – Pre-harvesting practices, HP – Harvesting practices, PP – Post-harvest practices, SP – Safety and precaution, FM – Farm management

Respondents' awareness in farm environment ( $r = 0.348$ ) and pre-harvesting practices ( $r = 0.354$ ) are highly significant when correlated with trainings while significant in terms of harvesting practices ( $r = 0.267$ ). The positive correlation implies that more trainings conducted to the corn farmers magnified their awareness on farm environment, pre-harvesting and harvesting practices. It further implies that generally, participation to trainings like proper storage of corn, how to make feeds and organic fertilizers, field days, and production of other crops and animal raising increased the farmers' knowledge and awareness on the effect of GAPs to corn farming especially in the environment, pre-harvesting and harvesting practices. Environmental protection supports sustainable agriculture while pre-harvesting and harvesting practices are important in the assurance of food safety. This indicates that trainings conducted in support to GAP is important to the respondents' awareness. Furthermore, the respondents were also trained on integrated farming and other alternative sources of income such as fishery, poultry and livestock and other crops like vegetables to supplement family income since corn takes more than three months to be harvested. Likewise, Azam and Banumathi (2015) denoted that educational attainment, age and gender of the farmers has positively motivated them to move towards GAP farming.

The correlation analysis in Table 2, finds no significant relationship between the demographic profile and extent of compliance in GAP corn. The result indicates that demographic characteristics has no effect in the farmers' compliance to GAP corn. This might be the reason for the very low (1.78%) GAP certification of corn farms in Nueva Vizcaya since all the requirements for certification should be complied 100%, partial compliance will be deferred. The respondents affirmed that GAP corn compliance is labor intensive since it needs more labor to comply with the criteria such as establishment of fences or barriers to prevent entry of animals and other predators, pest and diseases surveillance and strict implementation of field sanitation practices. The respondents claimed that they have 75-85% compliance since most of the farming practices were complied. It is the establishment of structures that they lacked. Adding that even if the farm will not be certified, they still need to maintain good agricultural practices always for environmental protection and health reasons. This is affirmed by the study of Ganpat et al. (2014) that compliance on GAPs among smallholder farmers was low.

**Table 2 Relationship between the demographic profile and extent of compliance in GAP corn**

Demographic profile	Extent of compliance in GAP corn							
	FL	FE	FSM	PHP	HP	PP	SP	FM
Age	-.039	-.037	-.038	-.039	-.038	-.038	-.038	-.038
Sex	.143	.141	.142	.142	.142	.142	.142	.142
Highest educational attainment	.096	.091	.095	.095	.095	.094	.095	.095
Land area for corn farming	.097	.097	.097	.097	.097	.097	.097	.097
Number of years in corn farming	.085	.087	.086	.085	.085	.086	.086	.086
Membership in farmer's organization	.017	.017	.017	.017	.017	.017	.017	.017
Membership in cooperatives	.016	.017	.016	.016	.016	.016	.016	.016
GAP trainings	.144	.144	.144	.144	.144	.144	.144	.144
Other trainings	.249	.245	.248	.248	.248	.248	.248	.248

\* Correlation is significant at the 0.05 level (2-tailed), \*\* Correlation is significant at the 0.01 level (2-tailed)

## CONCLUSION

Demographic characteristics of the corn farmers in Nueva Vizcaya, Philippines comprised men and women active involvement in farming, older farmers with a mean age of 52 years, most have formal education with 51.90% high school level or graduates, majority (58.2%) are small farm holders with an average land area of 1.93 hectares, more experience in farming with an average of

20 years and has membership in farmers organization (86.7%) and cooperatives (65.6%) and participation to GAP and GAP-related trainings with 96.3%. These characteristics towed their level of awareness which is high or qualitatively described to have 76-100% awareness of the GAP requirements while their compliance is moderate which is 51-75% compliant to GAP certification requirements that subsequently deferred their application for GAP certification. Generally, the corn farmers adopted GAPs especially in farm environment, farming practices for pre-harvesting and harvesting but their compliance to records of potential hazards in farm location, establishment of farm structures, post-handling practices, safety and precaution practices, documentation/recording and traceability in farm management needs to be improved.

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