Philippine e-Journal for Applied Research and Development 11(2021), 26-35 ISSN 2449-3694 (Online)
http://pejard.slu.edu.ph/vol.11/2021.09.20.pdf

Assessing the Benefits of Adopting Extension-Recommended Farm Practices on Corn Yield and Farm Income of Farmer-Scientists in Bondoc Peninsula, Quezon

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Received, 10 July 2021; Accepted, 13 September 2021; Published, 20 September 2021

Abstract

The Corn-based Farmer-Scientists Research, Development and Extension Training Program: Towards Food Sufficiency and Poverty Alleviation in Bondoc Peninsula, Quezon Province was implemented to increase the corn yield and income of its participants. However, it is not clear whether the project has benefited the farmer-scientists economically. Using a case study design, this study seeks to find out whether adopting recommended corn technologies/practices benefit the farmers-scientists in terms of their yield and income. Results showed that there was a significant change in corn yield (19%), farm income (31%), and total income (22%) after the training. Income from corn also increased (22%) but was found to be not significant as the respondents prioritize food supply and sell only surplus. These suggest that the adoption of the suggested corn technologies/practices has benefitted the farmer-scientists' economically. The findings may justify the project's continuation and even its expansion to 1st, 2nd and 3rd class municipalities to reach and help more farmers in the region.

Keywords: agricultural extension, participatory extension model, farmer-led extension, corn farm technologies, Philippines

Introduction

Agricultural extension is a system or service that helps farmers improve their techniques and increase production and income through educational means (Maunder, 1973; World Bank, 2014). Approaches to agricultural extension evolved from the initial top-down to participatory (Mutimba, 1977; Ison and Russel, 2000), whereby farmers are not only recipients of knowledge and technologies but also contributors to the generation, development and dissemination of these.

In the Philippines, one example of an agricultural extension program guided by the participatory extension paradigm is the "Corn-based Farmer-Scientists Research, Development and Extension (RDE) Training Program: Towards Food Sufficiency and Poverty Alleviation in Bondoc Peninsula, Quezon Province (FSTP-BonPen)." The project is part of the nationwide program entitled "Corn-based Farmer-Scientists RDE Training Program (FSTP) for Sustainable Agricultural Development," which is a collaboration among government agencies and state universities as stipulated in Executive Order 710 series of 2008 (FSTP Manual of Operations, 2009).

The FSTP-BonPen project's goal is to alleviate poverty and hunger by increasing the farmer-scientists' corn yield and income. It aims to achieve this by means of a training program

that introduces eight corn-based technologies/ practices for adoption and implementation by farmer-scientists. Specifically, these technologies/practices are as follows: two-plowing with weeding as land preparation method; use of germination test prior to planting; use of open-pollinated varieties of corn; planting of 1-2 corn seeds per hill; corn-based intercropping; use of organic fertilizers; integrated pest management; and, applying detasseling technique for corn borer control. The training program has three phases, namely: weekly classes for farmer-scientists, done simultaneously with established experimental trials (Phase I); on-farm experimental trials (Phase II); and, dissemination of knowledge to fellow farmers (Phase III). Under Phase I, the farmer-participants establish eight experimental trials involving the recommended technologies/ practices, which serve as their basis for observation, analysis and decision-making as to whether these technologies/practices are effective in increasing corn yield (see Annex I for details of the trials and treatments). This first cycle of training is conducted at the municipal level, with the experiments done in a selected study site. In Phase II, the farmer-scientists will re-establish the experimental trials but this time on their own farms at the village level so as to confirm compatibility of the recommended technologies/ practices. The implementation of the FSTP at the village-level is facilitated through a farmer-scientist association and with the help of the municipal local government unit. For Phase III, the trained farmers serve as extension agents by teaching their fellow farmers following the same training design of Phase I.

From 2011 to 2014, the FSTP-BonPen project was implemented by the University of the Philippines Los Banos – College of Agriculture and Food Science in partnership with the Agricultural Training Institute – Region 4A and the local government units of Buenavista, Catanauan, Mulanay, San Andres, San Francisco and San Narciso in Quezon province. These were the first batch of municipalities to implement and complete the project from Phase I - III. The project is continuously being implemented up to this time and now covers all the 12 municipalities in the Bondoc Peninsula district.

Post-training monitoring and evaluation reports from these municipalities showed that majority of the farmer-scientists have adopted some of the recommended technologies (FSTP Annual Reports, 2012-2017). The farmer-scientists also continue implementing the project in the different villages, as the project is incorporated within the annual budget of their Municipal Agriculture Office. However, to date, it is not clear whether the project has benefited the farmer-scientists economically, as no assessment has been done along this line.

This study, therefore, aims to find out if the adoption of corn-based technologies has benefitted the FS in terms of corn yield and farm income. To do this, it will pursue the following specific objectives: describe the farm profile, yield allotment, and income allotment of the respondents; examine the changes in their yield and income (corn, farm and total income) before and after the training; and, evaluate the relationship of their adoption of corn-based technologies/ practices and their corn, farm and total incomes. Knowing the economic effects of the adoption of recommended technologies and practices will justify the continued implementation of the project or even its expansion into the 1st, 2nd and 3rd class municipalities, given that it is currently limited among 4th, 5th and 6th class municipalities as stipulated in Executive Order 710.

Methodology

Study sites and survey respondents

The study areas include the municipalities of Buenavista, Catanauan, Mulanay, San Andres, San Francisco and San Narciso in Quezon province, where the FSTP-BonPen operated from 2011 to 2014. The study sites were chosen because of their accessibility, established partnership with local government units, the presence of sufficient number of respondents, and the continued execution of the project at the village-level. The study was conducted from January 2016 to May 2017 in order to cover two cropping seasons of corn.

The project produced a total of 421 farmer-scientists but only 79 of them finished Phase III. Out of the 79 who completed the trainings, 66 respondents were randomly selected using Yamane's formula, with 95% confidence level and

0.05% margin of error. Most of the respondents are male (62%), married (85%), and have an average of six children. Most of them finished 10 years of schooling and were considered as educated based on the average of nine years spent in school. Most of the respondents are old (53%), and came from Masbate and Cebu. Aside from migration to the family homestead, marriage is also one reason for their transfer to Quezon, especially among female respondents.

Study design and survey tool

The study is a case study design that used a survey as the main method, supplemented by focus group discussions (FGD) and key informant interviews (KII).

The survey questionnaire has four parts that covered the following: (1) basic information about the respondents and their families and farms; (2) sources of income, exact income from the last two cropping seasons, and yield and income allocation; (3) motivation and level of participation in FSTP-BonPen; and, (4) adoption of the project's recommended practices. The survey questionnaire was validated by experts from FSTP-UPLB team and pre-tested to farmer-scientists. It also underwent reliability test which revealed a very good result of Cronbach α=0.978. For the adoption part, a checklist of recommended practices was given, and respondents identified which among them have been adopted and used in their farm production. The reasons for their respective decisions were also asked. The survey was done face to face, lasting for 1.0 to 1.5 hours per respondent.

Key informant interviews and focus group discussions were done to supplement, validate and enhance the results from the surveys. The key informants were composed of the Farmer-Scientists Association presidents of each study site, the project Focal Persons (Agricultural Extension Workers), the Municipal Agriculturist/ Municipal Agriculture Officer of the study sites, and the village chairperson where trainings were conducted. Each KII lasted for 30 to 45 minutes and were guided by the questions about their experiences and learning in project implementation, general observation on their experiments, traditional farming practices and changes occurred in such practices after the training. For the FGDs, a group of six to eight farmer-scientists per study site was organized. Guide questions focused on their activities as federation of corn farmers, motivation to participate in the project, observations and learning acquired during the training, their usual yield and income allocation, and ranking of preferred practices and their reasons for adopting or not adopting these. Each FGD session lasted for 1.5 to 2.0 hours.

Statistical analysis and treatment of data

The study applied measures of central tendencies and variability to describe the relevant socio-economic and demographic variables. Pearson correlational analysis was used to examine the relationship of technology/practice adoption with corn yield, income from corn, farm income and total income of the respondents. T-test was also employed to determine if the change in yield and income was significant before and after the adoption of FSTP technologies. To minimize the effect of confounding factors, all study sites were represented in the sample, and the respondents were also identified randomly per study site. The mean corn yield, income from corn, farm income and total income obtained from two cropping seasons were computed and analyzed on a per hectare basis. The data on corn yield and income from the benchmark surveys done from 2011 to 2012 were used as basis for comparison with the current yield and income. For corn varieties, the study made use of corn yield and income data from open-pollinated varieties only; yield and income from hybrid corn varieties were noted but excluded in the computations for uniformity of variables, as not all respondents planted hybrid corn.

Results

Farm profile of respondents

More than half of the respondents (52%) spent 31 years or less in farming based on the average of 32 years (Table 1). Also, more than half of the respondents own the land they till (59%), while the rest are renting (41%). Some of the tenants were once farm owners but have either sold the farms or lost them due to indebtedness.

Table 1. Farm profile of the respondents

VARIABLES	FREQUENCY (n=66)	PERCENTAGE
Number of years in Farming		
Experienced	32	48
Less experienced	34	52
Land Tenure		
Owner	39	59
Tenant	27	41
Soil Analytical Services		
Availed	49	74
Did not avail	17	26
Usual Farming Problems*		
Insufficient capital	30	45
Lack of farm machineries	7	11
Pest infestation	37	56
Incidence of theft	5	8
Climate change	50	76
Stray animals	5	8
Lack of farm-to-market roads	5	8

**Multiple answers*

The average farm size is 2.24 hectares, with an average of 1.27 hectares devoted for corn production (either for subsistence, market or both). Most of the respondents (74%) availed of soil analytical services at least once every two years, while some (26%) never had their soils tested at all. Majority of the respondents (76%) claimed that changes in weather conditions, extreme drought and strong typhoons are the main problems, followed by pest infestation, and insufficient capital.

Yield Allotment

In terms of yield allotment, more than two thirds of the respondents (61%) stated that they plant corn both for consumption and market (white and yellow varieties); while the remaining respondents (39%) plant corn mainly for market as animal feeds (yellow varieties) (Figure 1). As for rice, majority of the respondents (86%) planted rice for consumption; a few did so for market purposes (5%) or for both consumption and market (9%).

They also plant various kinds of vegetables depending on season and market price. The respondents also raised animals like poultry and swine; poultry is usually for food, while swine is for market. Carabaos, cows and horses were also taken care of both for farm labor and transport services.

Income Allotment

In addition to spending on food, majority of the respondents (85%) allotted their income for the education of their children and/or grandchildren. Seventy-three percent (73%) used it as capital for the improvement of their houses, seventy percent (70%) for purchasing additional farm inputs and equipment; and, forty-one percent (41%) used it as capital for their other businesses (Figure 2).

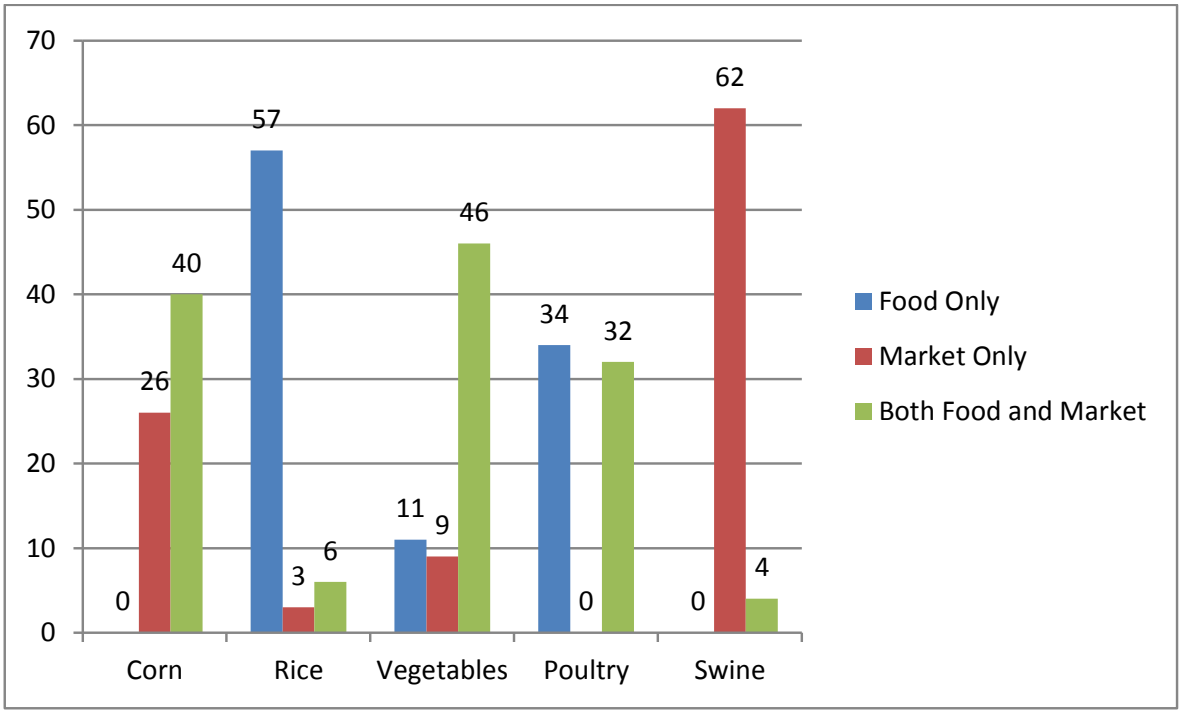

Figure 1. Yield allotment of the respondents (n=66)

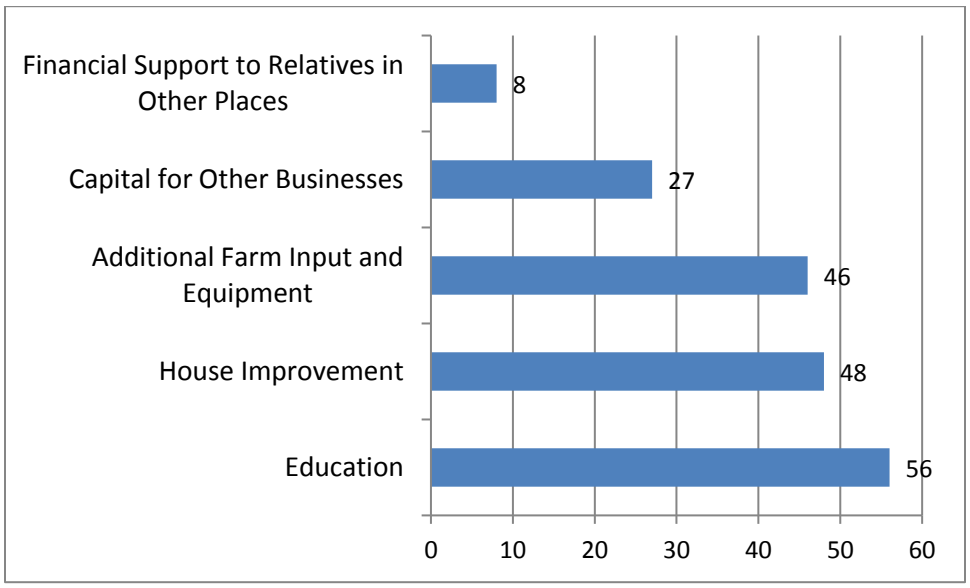

Figure 2. Income allotment of respondents (multiple answers; n=66)

Corn Yield (in tons) per Hectare

Based on the benchmark surveys done in 2011-2012, the average corn yield was 1.64 tons/hectare. This figure increased by 19% after the training (Table 2). Before the respondents attended the training, their yield was most likely the same (1.01 tons/hectare deviation from the mean), which became variable after the training (deviation of 1.44 tons/hectare from the mean). Using t-test, a highly significant change in yield before and after the training was computed. Aside from this, a very strong relationship was also noted as represented by the *r* coefficient in Table 2.

Corn, Farm and Total Income

The respondents' income from corn, farm and total income were obtained before and after the training, with the current income being re-computed based on the 2012 inflation rate of 3.2 (www.psa.gov.ph). Result showed that there is a 22% increase in the income from corn; 31% increase in the farm income; and 22% increase in total income before and after the training was conducted (Table 3). A high variation from the respondents' income can also be observed as indicated by high standard deviation.

Although there was a change in the respondents' income from corn before and after the participating in the training, it was found to be not significant (Table 4). On the other hand, the change in respondents' farm and total income was significant.

Using Pearson correlational analysis, it was found out that there are positive relationships between the adoption of corn-based technologies/ practices and the income from corn, farm and total income. This was true especially with the adoption of IPM and the increase in farm income which was significant (Table 5).

Table 2. Corn yield per hectare before and after the training

	BEFORE TRAINING (2011-2012)		AFTER TRAINING (2015-2016)
Mean	1.64		2.02
SD	1.01		1.44
t		-3.776	
df		65	
r		.947	
P-value		.000**	

**significant at 99% confidence

Table 3. Corn, farm and total income (in pesos) before and after the training

	BEFORE TRAINING (2011-2012)			AFTER TRAINING (2015-2016)		
	Income from Corn	Farm Income	Total Income	Income from Corn	Farm Income	Total Income
Mean	27, 078.29	87, 787.27	127, 424.17	34, 501.06	127.076.96	162, 324.84
SD	17, 368.26	53, 163.23	72, 138.57	28, 453.53	69, 333.44	79, 088.68

Table 4. T-test result for farm and total income (in pesos) before and after the training

	INCOME FROM CORN	FARM INCOME	TOTAL INCOME
t	-1.862	-6.261	-5.475
df	65	65	65
r	.075	.683	.769
P-value	.067	.000**	.000**

**significant at 99% confidence

Table 5. Relationship of corn, farm and total income with the adoption of technologies/practices

INCOME	TECHNOLOGY / PRACTICE							
	2-Plowing with weeding	Germination test prior to planting	Use of OPV	Use of Organic Fertilizer	IPM	Detasse-ling	1-2 seeds per hill	Intercropping
Income from Corn	.131	.016	.125	.096	.060	.071	.165	.071
Farm Income	.071	.070	.039	.054	.247*	.081	.002	.056
Total Income	.025	.064	.040	.131	.140	.009	.073	.113

*significant at 95% confidence

Discussion

The FSTP-BonPen aimed to increase the farmer-scientists' corn yield and income through the introduction and implementation of recommended corn farming technologies/ practices. The study results show that the farmer-scientists' adoption of these technologies/ practices has led to an increase in their yield. With the increase in yield, the respondents' income also increased as compared to the time prior to their participation in the FSTP-BonPen project. This resonates with the findings in several areas nationwide, showing that participation in FSTP resulted in increased technical efficiency of corn farms by 13% and increased productivity by 19%; thus, net income was doubled compared to farmers who did not undergo FSTP (Gabunada et al., 2015).

Based on qualitative data from the FGDs and KIIs, the respondents agreed that their adoption of their preferred technologies/practices resulted in an increase in their yield. Specifically, they recognized that the technology/practice of using 1-2 seeds per hill during planting contributed greatly; while they bought the same amount of seeds, they were able to plant larger areas and have spare seeds for replanting and thus, had more harvest as compared before when they planted 3-5 seeds per hill. Elsewhere, this practice of planting 1-2 seeds/hill at 0.16 meters apart has been proven to result in more nitrogen uptake and thus increasing grain yield (Bee et al., 2014).

The respondents also recognized the importance of germination tests prior to planting in improving their yields. The positive effect of using fewer seeds with good germination rates was already noted earlier by Gerpacio et al. (2004). As pointed out by the same authors, majority of corn production areas in the Philippines are rain-fed, thus ensuring good seed germination rate could mean efficiency in corn production. Tian et al. (2014) likewise found out that seed pre-treatment is an effective technique in improving germination percentage, germination rate, seedling growth and seed yield.

Another technology/practice whose benefit

was noted by the FS is corn-based intercropping, with corn as the main crop and sweet potato, mungbean and peanut as intercrops. By allocating various crops in different parts of their farm, they now maximize their farm production and can produce enough corn for food as well as vegetables and high-value crops for market. Thus, aside from the numeric increase in corn yield, the FS' variety of produce also increased. As a result, their total income now comes from various sources, which when accumulated, is higher than before when they depended mostly on corn planting and were also forced to sell their harvest on lower prices just to avoid bankruptcy. This is consistent with the findings of Chomba (2004) demonstrating that intercropping can be a risk-reduction strategy to lessen the effects of climate change and safeguard against crop failure.

The other technologies/practices like IPM and detasseling as pest control technique also contributed to higher net income. This can be attributed to the positive effects of IPM as biological control for pest infestation, as IPM does not only apply to corn but to other crops such as rice (Alam et al., 2016) and soybeans (Bueno et al., 2011). However, though significant, the relationship between farm income and IPM application remained weak. Aside from the pest control techniques, the combination of organic and inorganic fertilizers as alternative to purely inorganic fertilizers also contributed to their crop increase, which is consistent with what Timsina (2018) has found.

Aside from the advantages brought about directly by the corn technologies/practices that were adopted by the FS, the farmers themselves recognized that their association is also an added factor. The farmer-scientists now compete with market prices with the help of the association especially when they are dealing with buyers of large quantities. Contract farming was also one of their strategies to ensure their income.

Yet while the change in respondents' farm and total income was found to be significant, the increase in the respondents' income from corn was found to be not significant. In spite of the significant increase in corn yield, this has not immediately translated into an increase in income. This is because most of the respondents also consume corn grits as staple food, and they secured first enough corn produce for food and sold only the surplus. In a way, this made them food sufficient, and whatever excess they were able to sell went to sustaining their other needs.

This study is limited to the potential benefits on the corn yield and farm income of the respondents through the improvement of their farm practice by adopting corn technologies/ practices. It does not look into measures of food sufficiency and poverty alleviation for the FS, areas that can be considered by future studies. Moreover, as the study was limited to the FS in Bondoc Peninsula, a comparative study on the results of the other FSTPs in the country would be interesting.

Conclusion

Participation in the FSTP-BonPen project has led to an increase in the farmer-scientists' corn yield, farm income and total income. This was primarily a result of their adoption of the corn-based technologies/practices recommended by the project. Moreover, the farmers' integration into associations has also helped them organize and negotiate for better prices for their products, thus adding to their income. Thus, overall, it can be concluded that the FSTP-BonPen project has benefited the farmer scientists economically. The results of this study may justify the project's continuation and even its possible expansion to 1st, 2nd and 3rd class municipalities to reach and help more farmers in the region.

Acknowledgment

The author thanks the local government units where the study was conducted, and the respondents for sharing their valuable time and knowledge. Sincere gratitude also goes to the FSTP-UPLB Program Leader RG Davide and staff for their assistance in conducting the study; and, to RDT Baconguis, JT Dizon and JM Pulhin for their guidance.

References

Alam, M.Z., Crump, A.R., Haque, M.M., Islam. M.S., Hossain, E., Hasan, S.B., Hasan, S.B., and Hossain, M.S. (2016). Effects of Integrated Pest Management on Pest Damage and Yield Components in a Rice Agro-Ecosystem in the Barisal Region of Bangladesh. *Journal Frontiers in Environmental Science, 4, Article 22*. http://dx.doi.org/10.3389/fenvs.2016.00022

Bee, K.C., Omara, P., Macnack, N., Mullock, J., Dhital, S., and Raun, W. (2014). Effect of seed distribution and population in Maize (*Zea mays* L.) grain yield. *International Journal of Agronomy*, *2014*, *Article ID 125258*. http://dx.doi.org/10.1155/2014/125258

Bueno, A.D.F., Batistela, M.J., De Freitas Bueno, R.C.O., De Barros Franca-Neto, J., Nishikawa, M.A.N., and Filho, A.L. (2011). Effects of Integrated Pest Management, Biological Control and Prophylactic Use of Insecticides on Management and Sustainability of Soybeans. *Crop Protection, 30 (7), 937-945*. https://www.sciencedirect.com/science/article/abs/pii/S0261219411000640

Chomba, G.N. (2004). Factors Affecting Smallholder Farmers' Adoption of Soil and Water Conservation Practices in Zambia. MS Thesis. Michigan State University. http://www.oalib.com/references/15292759

FSTP-BonPen Annual Reports (2012-2017). Agricultural Systems Institute, College of Agriculture and Food Science, University of the Philippines Los Banos.

FSTP Manual of Operations (2009). Agricultural Systems Institute, College of Agriculture and Food Science, University of the Philippines Los Banos.

Gabunada, F.M., Patindol, R.A., Cagasan, E.G., Anwar, S.B. and Recto, A.L.M. (2015). Farm-level Impact of the National Corn-based Farmer-Scientists Research, Development and Extension Training Program (FSTP). A Terminal Report (unpublished). Visayas State University. Baybay City, Leyte

Gerpacio R.V., Labios, J.D., Labios, R.V., and Diangkinay, E.I. (2004). *Maize in the Philippines: Production systems, Constraints and Research Priorities*. Mexico. D.F.: CIMMYT

Ison, R.L. and Russell, D.B. (2000). Agricultural Extension & Rural Development: Breaking Out of Traditions (A Second Order Systems Perspective). Cambridge University Press. http://catdir.loc.gov/catdir/samples/cam032/98051725.pdf

Maunder, A.H. (1973). Agricultural Extension. A Reference Manual (Abridged version). Rome: *Food and Agriculture Organization of the United Nations*.

Mutimba, J.K. (1997). Farmer Participatory Research: An Analysis of Resource-poor Farmer Involvement in, and Contribution to, the Agricultural Process in Zimbabwe. Department of Agricultural Economics and Extension. University of Zimbabwe.

Tian, Y., Guan, B., Zhou, D., Yu, J., Li, G., and Lou, Y. (2014). Responses of Seed Germination, Seedling Growth and Seed Yield Traits to Seed Pre-Treatment in Maize (*Zea mays* L.). *The Scientific World Journal, 2014, Article ID: 834630*. doi.org/10.1155/2014/834630

Timsina, J. (2018). Review: Can Organic Sources of Nutrients Increase Crop Yields to Meet Global Food Demand? *Agronomy, 8(10), 1-20*.

World Bank (2014). Agricultural Extension Lessons and Practices. No. 6, Operation Evaluation Department. http://wbln0018.worldbank.org/opd/oeddoclib.nsf/812f643.

Annex A. Experimental trials and treatments established under FSTP

Experimental Trials	Treatments
Land Preparation	a. No plowing, no weeding
	b. No plowing + weeding
	c. One plowing + weeding
	d. Two plowing + weeding
Germination	a. Dry Seeds
	b. Seeds soaked in water for 2 hours
	c. Seeds soaked in water for 4 hours
	d. Seeds soaked in water for 8 hours
Varietal*	a. Native variety usually planted in the area
	b. IPB Var 6 (white)
	c. IPB Var 11 (yellow)
	d. LB Lagkitan (glutinous)
Population Density	a. One seed per hill
	b. Two seeds per hill
	c. Three seeds per hill
	d. Four seeds per hill
	e. Five seeds per hill
Corn-based Intercropping	a. Corn alone
	b. Corn + mungbean (*Vigna radiata*)
	c. Corn + sweet potato (*Ipomea batatas*)
	d. Corn + peanut (*Arachis hypogaea*)
Fertilizer	a. No fertilizer
	b. Locally available organic fertilizers
	c. Bio-N **
	d. Combination of organic and inorganic fertilizers
Integrated Pest Management	a. No treatment
	b. Release of Earwigs (order Dermaptera)
	c. Release of Trichogramma (order Hymenoptera)
Detasseling	a. No detasseling
	b. Detasseling two rows out of four rows per plot
	c. Detasseling three rows out of four rows per plot

(Source: FSTP Manual of Operations, 2009)
*OPVs of corn for testing depend on availability at the Institute of Plant Breeding, UPLB
** Bio-N is a microbial fertilizer produced and commercially available at the National Institute of Molecular Biology and Biotechnology (BIOTECH), UPLB.