

Research article

# Extent of Adoption of the Corn Integrated Crop Management Technology by the Farmer's Field School ( FFS-CICM) Graduates in Central Luzon, Philippines

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## Abstract

The Farmers' Field School (FFS) in the Philippines is an approach used particularly by the Department of Agriculture-Agricultural Training Institute in training farmers since it employs experiential learning activities. As per the post test result, FFS graduates performed better as shown in their scores from 11-15 i(51%) to 16-20 (53%) . The following practices were fully applied: 1) full tillage 2) use of bio fertilizer, 3) use of chemical spray, 4) recommended planting distance and 5) record keeping. The graduates were satisfied with the AT's services in terms of number assigned, frequency of visits, relevance of services, responsiveness to issues raised, extension methods used and technologies shared. Corn harvest increased (36%) from 3,499 kg/ha to 4,765kg/ha after the FFS, many of

the respondents (44%) however, have not planted corn after the FFS. The farmers reported the following problems in order of their importance: 1) high input cost, 2) low price for corn, 3) natural calamities and 4) lack of irrigation water. Measures suggested to help improve corn productivity include the provision of the following: 1) low interest loan, 2) high quality seeds at subsidized prices and seed replacement during calamities, and 3) assistance in putting up irrigation facilities. In general, the FFS modality of technology transfer is effective in terms of acquisition of knowledge, skills and right attitude among the participants that is translated in increase of yield and income to some extent.

**Key words:** Farmers field school, adoption, corn integrated crop management, Philippines

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## 1. Introduction

Corn ranks second to rice as important grain and food crop in the country, being the staple of one-fifth of the population and yellow corn as vital ingredient in animal feed production and processed food products (Vasal, 2005). It is the major source of livelihood of some 600,000 households and provides livelihood to transport service providers, traders, processors and agricultural input suppliers. Compared to other major corn producing countries, Philippines lags behind with its average corn productivity of 4.09 metric tons per hectare (BAS, 2012). Despite the increasing demand for corn, overall production is low and insufficient (BAR R&D Digest, October-December 2011). To address the problem of low corn productivity, Season Long Training of Trainers (TOT-Corn Production) was conducted to capacitate Agricultural Extension Workers (AEW's) in transferring new technology in corn integrated crop management to farmer clients. During the regional TOT-Corn ICM conducted last March 4 to June 28, 2013, twenty five AEW's from the six provinces of Region 3 attended. After their TOT, the AEW's implemented Farmers Field School on Corn- Integrated Crop Management (FFS Corn-ICM) in their respective local stations with an average of three batches, each batch comprising 25-30 participants. This paper aimed to evaluate the performance of the FFS- Corn ICM in terms of the extent of adoption of knowledge, skills and attitudes acquired by the graduates from the program. Data and information gathered are important inputs in deciding plan of activities for the improvement of corn productivity in the region.

## **Materials And Methods**

This study was undertaken using descriptive research design. It utilized questionnaire as the main instrument in data gathering coupled with focused group discussion and face to face interview with farmer respondents.

Data gathered were analyzed using mean, frequencies and percentages. T-test was used to describe the change of knowledge, skills and attitudes acquired from FFS-Corn ICM. Simple correlation analysis was used to determine the relationship between selected variables.

The study was conducted in the six provinces of the Philippines which include Zambales, Bataan, Pampanga, Bulacan, Aurora, Nueva Ecija and Tarlac. A total of 240 farmer-graduates of FFS-Corn ICM batch 2013 and 2014 in 23 municipalities of Region 3 were the respondents of this study.

## **Results and Discussion**

### **I. Socio Demographic Profile of Respondents**

FFS-Corn farmer- graduates in region 3 are in their prime age with a mean of 51 years old. Most (29 %) are within the bracket of 50-54 years old, the youngest at age 22 and the oldest 89. The greater majority are almost equally distributed within the age range of 40 to 59. Almost all are married (85%) with only very few single (7%) and widowed (8%) as indicated in Table 1.

Majority (59%) of the farmers have annual income ranging from 55-99 thousand pesos while many (26%) have annual income of less than 50 thousand pesos. This translates to a monthly income of PHP4, 583.33 to PHP8, 250 if the farmer has no other sources of income aside from farming, which is way down the poverty line. Only one farmer-respondent declared an annual income of almost 500 thousand pesos and two others earn an annual income of 300-349 thousand pesos. Generally, high corn yield is directly associated with the farmer's ability to provide the necessary input for better crop productivity. Farmers with income below the poverty line would have to take extra effort to produce a good crop stand.

**Table 1. Age, Civil Status, Sex and Annual Income of Respondents**

<b>Age Range</b>	<b>Frequency</b>	<b>Percentage</b>
80 Above	4	2
75 -79	5	2
70 -74	6	2
65 – 69	27	11
60 – 64	27	11
55 – 59	33	14
50 – 54	47	29
45 – 49	31	13
40 – 44	34	14
35 – 39	12	5
30 – 34	9	4
25 – 29	3	1
20 – 24	2	1
<b>Total</b>	<b>240</b>	<b>100</b>

Average age: 51. Age range: (22-89)

<b>Sex</b>	<b>Frequency</b>	<b>Percentage</b>
Male	195	81
Female	45	19
<b>Total</b>	<b>240</b>	<b>100</b>

<b>Civil Status</b>	<b>Frequency</b>	<b>Percentage</b>
Single	17	7
Married	204	85
Widowed	19	8
<b>Total</b>	<b>240</b>	<b>100</b>

Annual Income(Thousand Pesos)	Frequency	Percentage
450 & Above	1	1.0
400 – 449	0	0
350 – 399	0	0
300 – 349	2	1.0
250 – 299	0	0
200 – 249	4	2
150 – 199	5	3
100 – 149	13	8
50 – 99	94	59
< 50	41	26
<b>Total</b>	<b>160</b>	<b>100</b>

\* *No data – 80*

**Table 2. Educational Attainment of FFS Graduates**

Educational Attainment	Frequency	Percentage	Rank
Elem Undergraduate	11	5	
Elem Graduate	42	17	2
High School Undergraduate	6	3	
High School Graduate	113	47	1
College Undergrad	11	5	
College Graduate	27	11	
VocTech Graduate	30	12	3
<b>Total</b>	<b>240</b>	<b>100</b>	

Majority of the FFS-Corn ICM graduates are high school graduates (47%), many finished elementary school (17%) while some are graduates of vocational technology(12%) and have college degrees (11%)(Table2). In terms of farm size, the farm area of respondents ranged from less than a hectare to over five hectares with most (50%) having 1-1.9 hectares and some less than a hectare both for owned and tenanted farms (Table 4).

**Table 3. Farm Area and Tenurial Status**

Farm Area (HA)	Tenurial Status			
	Owned		Tenanted	
	Frequency	%	Frequency	%
5 & Above	7	2.92	6	2.5
4 - 4.9	4	1.67	7	2.92
3 - 3.9	24	10.0	13	5.42
2 - 2.9	32	13.33	34	14.17
1 - 1.9	120	50.0	127	52.92
Below 1	53	22.08	53	22.08
<b>Total</b>	<b>240</b>	<b>100</b>	<b>240</b>	<b>100</b>

Aside from FFS- Corn ICM, the respondents also have attended various trainings such as PalayCheck (59), Vermi Composting (4), Organic Fertilizer Production (3), Vegetable Production (21), and Food Processing (5). Many (30%) however, have not attended trainings other than FFS-Corn ICM (Table 5).

Most (80) farmers attended trainings that were conducted by DA-LGU, presumably because the agency is directly responsible in the dissemination of new farming technologies to the farmers. It is noted that many farmers have also attended trainings at the regional levels conducted by DA-RFU3 (46), ATI (80) &PHILRICE and DAR.

**Table 4. Trainings/Seminars Attended and Sponsoring Agency**

Title of Trainings	Frequency	Rank
Palay Check	59	3
FFS Corn	240	1
Vermi Composting	4	
Organic Fertilizer Production	3	
Vegetable Production	21	4
Food Processing	5	
No Training other than FFS Corn	72	2
Sponsoring Agency	Frequency	Rank

DA-LGU	80	1
ATI	8	3
PHILRICE	1	
DAR	1	
RFU III	46	2
GAD	2	
NO TRAINING	63	

\*Multiple response

## II. Farmer’s Field School On Integrated Crop Management (Ffs-Icm): **Brief**

### Description And Performance Of Graduates

FFS-ICM as implemented in the Philippines through the Department of Agriculture-Agricultural Training Institute (DA-ATI) is a season-long training program which creates opportunities among farmer-participants learn by doing specific activities/technologies to improve farm productivity and farmers income. It is done by allowing the farmers attend lectures twice a week which later is applied in demonstration farm that is tended by the group as a class. Hand-in-hand with the class demo farm, each participant is also expected to apply same principles in managing his/her own corn farm. Specific technologies commonly promoted in FFS include integrated pest management such as use of earwigs in corn production, distance of planting, and tillage practices ( Eunice Montenegro, DA-LGU, 2015). Performance of FFS students are assessed through pre-test/post-test and actual application of learned technologies in farm management that is reflected later in yield. It is conducted to coincide with the planting season for corn, commonly as second crop after rice.

#### 1. Pre-test/Post –test

Performance of FFS farmer- graduates in terms of pre-test/post-test result is very positive as scores of majority (51%) increased from 11-15 to 16-20 (53%). Those who scored 6-10 (32%) were reduced to six (3%) and no more farmerscored less than five in the post test. Furthermore, those who hit the highest score range of 21-25 increased by 16% (Table 6). Scores of 30 farmers however, were not available.

**Table 5. Pre-test/Post-test Score**

Score	Pre-Test		Post-Test	
	Frequency	%	Frequency	%
21–25	2	0	38	16
16–20	32	16	115	53
11–15	111	51	51	25
6–10	64	32	6	3
0–5	1	1	0	0
<b>Total</b>	<b>210</b>	<b>100</b>	<b>210</b>	<b>100</b>

Note: scores of 30 respondents not available.

## 2. Acquisition of Knowledge, Skills and Attitude Change

The knowledge acquired by farmers regarding corn integrated crop management increased significantly ( $t_{comp}=23.584^*$ ) as perceived by the farmers (Table 7). Items evaluated include the general concepts discussed during FFS Lecture such as, 1) Principles of Corn-ICM, 2) Farm Plan and Budget, 3) Record Keeping, 4) Site and Varietal Selection, 5) Land Preparation, 6) Fertilization, 7) Integrated Pest Management, 8) Harvesting and, 9) Post harvest Technology.

**Table 6. Perception of Farmers Regarding Knowledge Acquired From the FFS**

Knowledge	Mean			
	Before	Descriptive Rating	After	Descriptive Rating
1. Principles of ICM	1.45	N	2.46*	K
2. Farm Plan & Budget	1.37	N	2.48*	K
3. Record Keeping	1.47	N	2.44*	K
4. Site & Varietal Selection	1.63	K	2.63*	V
5. Land Preparation	1.96	K	2.78*	V
6. Fertilization	1.83	K	2.72*	V



7. Integrated Pest Management	1.35	N	2.55*	V
8. Harvesting	1.84	K	2.7*	V
9. Post-Harvest Technology	1.66	K	2.55*	V

\*significant at 0.05 level using T-test

The farmers' skills pertaining to Corn ICM also increased substantially ( $t_{comp}=11.237^*$ ) according to the farmer-graduates (Table 8). The skills are: 1) Use of correct corn variety, 2) Reliable source of seeds, 3) Application of zero, minimum, or full tillage, 4) Correct planting distance, 5) Application of irrigation water at the right time, 6) Use of right amount of fertilizer, 7) Correct time and method of fertilizer application, 8) Weeding, 9) Use of earwigs to control pests, 10) Use of chemical spray, 11) Recording of correct information, 12) Detasselling, 13) Harvesting and threshing, 14) Drying grains to desired moisture content, 15) Storing grains in well-ventilated rooms.

**Table 7. Skills in the Use of Technology**

Skills	Mean			
	Before	Descriptive Rating	After	Descriptive Rating
1. Use of correct corn variety	1.64	S	2.03*	S
2. Reliable source of seeds	1.65	S	2.61*	HS
3. Application of zero, minimum or full tillage	1.29	NS	2.3*	S
4. Correct planting distance	0.79	NS	2.66*	HS
5. Application of irrigation water at the right time	1.67	S	2.72*	HS
6. Use of right amount of fertilizer	1.55	S	2.66*	HS
7. Correct time & method of fertilizer application	1.4	NS	2.66*	HS
8. Weeding	1.86	S	2.65*	HS
9. Use of earwigs to control pests	1.11	NS	2.35*	S
10. Use of chemical spray	1.62	S	2.53*	S
11. Recording of correct information	0.79	NS	2.44*	S
12. Detasseling	1.29	NS	2.47*	S
13. Harvesting & Threshing	1.77	S	2.65*	HS

14. Drying grains to desired MC	1.98	S	2.58*	HS
15. Storing grains in well-ventilated room	1.46	NS	2.58*	HS

\*significant at 0.05 level using T-test

As in the acquisition of knowledge and skills, the attitude of farmers towards corn production also significantly changed, ( $t_{comp}=5.853^*$ ). From undecided (U), their perception on three items changed into agree (A) and from agree (A) to strongly agree (SA) (Table 9).

**Table 8. Attitude Change of Farmers Towards Integrated Corn Management**

Attitude Change of Participants Towards Integrated Corn Management	Before	Mean		Descriptive Rating
		Descriptive Rating	After	
1. Corn production is profitable as second crop planted after rice.	3.53	A	4.56*	SA
2. Use of recommended variety is important to attain good yield.	3.87	A	4.57*	SA
3. Modern and alternative technologies are necessary to improve quality and increase production in corn.	3.45	U	4.59*	SA
4. Use of farm plan and budget helps in achieving production target.	3.33	U	4.43*	A
5. Zero, minimum or full tillage can be employed for optimum corn yield.	2.04	D	4.19*	A
6. Use of earwigs helps control insect pests.	2.05	D	4.18*	A
7. Chemical sprays are necessary to control pests but should be used judiciously.	3.23	U	3.85*	A
8. Use of organic fertilizer is beneficial both to man and environment.	3.58	A	4.52*	SA

\*significant at 0.05 level using T-test

The farmer respondents have total farm area of 427.45 hectares classified into landowners and tenants with 257.1 and 170.35 hectares respectively for owned and tenanted farms. There are more areas that are owned (60%) by the farmers than areas tenanted (40%) (Table 3). The farmers till an average of 1.7 hectares per farmer. White corn is considered as minor crop among the farmers with only 28.6 hectares total area planted or an average of 0.28 hectare/farmer. Of the total area planted (236.35 hectares) 88% is planted to yellow corn and the remaining, to white corn. Only 55% of the total farm areas were planted to corn.

**Table 9. Application of learned/ recommended practices**

<b>Recommended Practices</b>	<b>Not Applied</b>	<b>Applied</b>	<b>Total</b>
1. Seed/Variety Selection	6	226	232
2. Integrated Nutrient Management	127	104	231
3. Zero Tillage	217	15	232
4. Minimum Tillage	123	26	149
5. Full Tillage	15	212	227
6. Use of Earwigs	228	0	228
7. Use of Biofertilizer	82	145	227
8. Use of Chemical Spray	0	203	203
9. Distance Planting:			
70x30	24	87	111
75x20	16	113	129
10. Record Keeping	94	109	203

\*Multiple response

Most of the farmers were generally satisfied and highly satisfied by the AT's services in all the items rated as follows: 1. Number of AT's assigned, 2. Frequency of visits, 3. Relevance of services, 4. Responsiveness to problems/issues, 5. Extension methods used, 6. Technologies shared ( Table 11).

**Table 11. Farmer's Level of Satisfaction on Services of ATs**

Farmers' Level of Satisfaction on Services of Agricultural Technicians	Not Satisfied		Satisfied		Highly Satisfied		TOTAL
	Frequency	%	Frequency	%	Frequency	%	
1. Number of ATs assigned	2	.88	127	56.19	97	42.92	<b>226</b>
2. Frequency of site visits	2	.87	120	52.40	107	46.72	<b>229</b>
3. Relevance of services	0	0	123	53.94	105	46.05	<b>228</b>
4. Responsiveness to problems/issues raised	1	.44	116	51.10	110	48.46	<b>227</b>
5. Extension method/s used	0	0	118	51.30	112	48.69	<b>230</b>
6. Technologies shared	1	.44	122	53.04	107	46.52	<b>230</b>

**Multiple response\***

### III. PRODUCTION AND INCOME

#### 1. Effect of FFS Corn-ICM on Harvest

Before FFS training, the farmers had average corn harvest of 3,499 kg/ha or approximately 3.5 mt/ha. This was increased to 4,765 kg (4.765mt/ha) after the FFS or an increase in 36 % from the previous harvest. Many of the respondents (44%) said they are still to plant corn for 2015 during the data gathering, thus the 140 no response.

The yield of the farmers before the FFS (3.499 mt/ha.) is comparatively the same as the national average corn production of 4.09mt/ha (BAS 2012). The yield increased to 4.765mt/ha. or 1.2mt/ha after the FFS. Translated to income, the average income from corn production among farmers isPhp 41,988.0 and the highest that a farmer will earn from a hectare of corn is PHP57, 180.00 at Php12.00/kg.

**Table 12. Harvest/Yield**

Yield (kg) (Yellow)	Corn Farmers				% Increase/ Decrease
	Before		After		
	Frequency	%	Frequency	%	
5,001 - above	49	20	71	30	45
4,001 -4,500	20	8	7	3	(65)
3,501 – 4,000	18	8	11	5	(39)
3,001 – 3,501	8	3	7	3	(12)
2,501 -3,000	9	4	15	6	67
2,2001 -2,500	11	5	10	4	(9)
< 2,000	19	8	13	5	(31)
No response	106	44	106	44	0
	<b>240</b>	<b>100</b>	<b>240</b>	<b>100</b>	

Mean Harvest Before FFS = 3,499kg/ha

Mean Harvest After FFS = 4,765 kg/ha

Most farmers, 20% to 30% respectively, have corn harvest of 5,000kg and above, before and after the FFS with 10% increase compared to the previous harvest. A decline however, in farmers harvesting from 3,500 to 4,000 kg (13%) and 3501 to 4,500 (5%) was observed (Table 12).

### Problems Encountered

Enumerated in Table 9 are the problems encountered by FFS-graduates on corn production with the item, high input cost, as the most voted (Rank 1) followed by low price for corn and natural calamities including lack of irrigation water. Seemingly, these are the most pressing problems of corn farmers.

Corns are mostly planted in rainfed and upland areas as second crop after the main crop of rice because water cannot sustain another rice crop. If water is limiting during the growth and grain- filling stages of development, it is likely that the farmers will harvest empty cob.

High input cost is a problem because most of the corn farmers belong to the lower bracket of society in terms of income. Corn is considered high input crop and failure to provide the necessary inputs, mineral nutrition and pest control measures will result to low crop yield.

**Table 13. Problems Encountered by corn farmers.**

<b>PROBLEMS ENCOUNTERED</b>	<b>Frequency</b>	<b>Rank</b>
1. Lack of quality seeds	98	8
2. Lack of irrigation water	134	4
3. Lack of technical know- how	60	9
4. Low price for corn	177	2
5. Prevalence of insect pests and diseases	102	7
6. Lack of inputs	128	5
7. High input cost	201	1
8. Lack of postharvest facilities	109	6
9. Natural Calamities	154	3

\*Multiple response

### **Suggested Solutions to Problems**

In the light of the above-mentioned problems, the following were suggested by the respondents to help improve corn productivity.

1. DA should coordinate for the farmers, loan availment with banks that provide low interest rate.
2. Request DA to provide quality corn seeds to farmers at subsidized price.
3. In case of calamities, DA-LGU should provide seed replacement for replanting of damaged crops.
4. Use alternative technologies that are cheaper for the control of pests.
5. To provide incentive and motivate farmers to plant or expand area planted to corn; a subsidy should be worked out to cushion price fluctuation for corn.
6. Assist farmers in providing irrigation facilities especially in upland and rainfed corn areas.
7. Provide water pump for the common use of group of farmers.

## **Discussion**

Farmers Field School-ICM is a worldwide participatory approach to farmer empowerment implemented by 90 countries with an estimated 10-15 million farmer graduates (I Ketut Kariyasa, 2014). Use of FFS-ICM was reported to positively influence technology adoption by farmers. In Indonesia, ICM-FFS program could increase corn productivity by 30.95% and farmers income by 71.03% compared to non ICM-FFS farms. Further, systematic review conducted (Hugh Waddington et. al., 2014) on FFS as approach for improving practices and farm outcomes indicate that FFS are beneficial in improving knowledge and adoption of beneficial practices, as well as production and farmers' incomes. The most often learned and promoted technology is Integrated Pest Management (IPM) and other techniques. A few farmers are empowered as evidenced by a feeling of greater self-confidence. However, among papers reviewed, no hard evidence point out that FFS directly influence increase in income. This study was conducted as component part of a bigger project to assess the effectivity of FFS-ICM in corn production in this part of the country. Study 1 intended to evaluate the effectivity of the training program for trainers (FFS-TOT) that may affect in return the adoption of farmers of new and improved techniques for better corn yield.

## **V. CONCLUSIONS AND RECOMMENDATIONS**

1. The farmer- graduates are still in their prime age and hence can carry on the heavy tasks of farming. However, they are not rich and are having difficulty in providing for farm inputs for improved corn productivity. The average yield may be high compared to BAS report (4.09mt/ha.) but currently, the average corn yield is almost 6mt/has.
2. Natural calamities as well as source of irrigation water is an observed problem among corn producers. If water pumps will be provided for the common use of the farmers, corn production will improve.
3. The farmers tend to favor chemical farming because of its availability and ease of application compared to organic fertilizers although they know the damage of chemicals to the farm and the environment. The farmers should be trained to produce organic fertilizers or compost for their use if sustainable corn yield is desired.

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## **STATEMENT OF NO CONFLICT OF INTEREST**

We the authors of this research paper hereby declare there are no competing interests in this publication.

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