Asian Journal of Rural Development

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Asian Journal of Rural Development 3 (1): 1-13, 2013
ISSN 1996-336X / DOI: 10.3923/ajrd.2013.1.13

Role of Farmer Field School and Farmer Research Group in Bringing Attitudinal and Knowledge Change: The Case of Integrated Potato Disease and Nutrient Management in Ethiopia

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ABSTRACT

The study was conducted to identify the role of Farmer Field School (FFS) and Farmer Research Group (FRG) in bringing attitudinal and knowledge change among farmers who hosted integrated potato disease and nutrient management practices. Attitude and knowledge of institutions, organizations, groups and farmers on the practices was assessed before and after the project. Data from these sources were collected using Rapid Appraisal of Agricultural Knowledge System (RAAKS), case study, focus groups discussions and observation. A workshop was organized to gather information from institutions and organizations who were engaged in potato promotion. Experienced rapporteurs inputted information generated on the workshop into computer database. Checklist was developed and used to collect information from farmers of both FFS and FRG. Likert scale was used to analyze data using Statistical Package for Social Sciences and Microsoft Excel. Findings indicated that active participation of farmers in potato promotion is very mandatory to empower them as its production is knowledge intensive and input based. Findings also pointed out that the role FFS and FRG played in bringing attitudinal and knowledge change depended on the issues handled and the way the approaches were used and treated by facilitators. Therefore, the two approaches should be used in combination to fill each other's weakness in bringing attitudinal and knowledge change. Since the costs of investment on knowledge are higher at initial years and attitudinal and knowledge change is expected in subsequent years, development practitioners should take the long term impacts of the approaches while evaluating their feasibility.

Key words: Farmer field school, farmer research group, integrated disease management, integrated nutrient management, potato

INTRODUCTION

Many African countries need enhanced food production to alleviate poverty since their mode of agricultural production is subsistence. Moreover, the rate of population growth in these countries far exceeds agricultural productivity and production. To increase food production and enhance food productivity to be self sufficient, most of these countries have been engaged in potato promotion as staple food crop. It has also been noted that the poor and undernourished households in these countries depended on root and tuber crops as an important source of food and nutrition

(Alexandratos, 1995). Empirical studies in African countries indicate that potato has the highest rate of growth and is attracting emerging markets, which is an opportunity for resource poor farmers to generate additional income (Scott *et al*., 2000).

Research for development is being underway in many African countries in order to increase production and productivity of potato. As a result, a number of potato technologies have been generated and transferred to end users including farmers. These technologies are either input-based or knowledge-intensive in their nature. Input based technologies are those where the physical component of the technology is dominant (Rogers, 1995). According to the same source such kinds of technologies usually have direct effects on the yield and depend mostly on the availability of a physical input such as varieties and agrochemicals. In knowledge intensive technologies such as integrated pest management and integrated nutrient management, farmers are capacitated through hands on training, experience sharing and learning biophysical principles. Rogers (1995) named this kind of knowledge as the software of the technology.

Review of past extension approaches indicated that with regards to enhancing potato production and productivity, FFS and FRG were separately used though both are participatory approaches. These participatory approaches were used because they involve farmers in technology design and evaluation. Active participation of farmers is believed to generate technologies that have higher probability of adoption by resource poor farmers. The effects of participatory methods even goes beyond farmer level to research and extension system, with increased interactions among researchers, extension workers and farmers (Okali *et al*., 1994; Selener, 1997). Participation seems to be appropriate in terms of efficiency of the research and development interventions, equity and power relationships, particularly when dealing with poor rural families and also at the levels of human and social capital (Maza *et al*., 2000; Quijandria *et al*., 2001).

A number of participatory approaches used in research for development do have different degree of farmers' participation in the development processes. Extension approaches that require higher farmer participation are too expensive to be sustainable in fiscal terms (Quinzon *et al*., 2001). Although, participatory approaches have been studied extensively (Pretty, 1995; Selener, 1997), their appropriateness for different technologies has not been examined. It is also reported that production of potato for food security has generally not been accompanied by the roles participatory approaches played, but rather by the adoption of readily available technologies. This has led to pesticide abuse and resulted in detrimental effects on the health of resource poor farmers (Cole *et al*., 1998). Nevertheless, the use of FFS and FRG approaches in combination is hypothesized to fill the weakness of one another and addresses both knowledge intensive and input based technologies of potato production. Although this kind of analysis is missing in the literature, it would be a useful tool for institutions that wish to define strategies for scaling up/out participatory approaches for integrated potato disease management and integrated nutrient management. Therefore, this study attempts to identify the role of FFS and FRG in bringing attitudinal and knowledge change among farmers who hosted integrated potato disease and integrated nutrient management in Ethiopia.

MATERIALS AND METHODS

Study area: The study was conducted in Jeldu, Galessa, Welmera and Degam weredas in the central highlands of Ethiopia. These Weredas were selected in consultation with respective agricultural offices as they are potential areas for potato production. As a result, three years project entitled Integrated potato disease management and integrated potato nutrient management for

enhanced potato productivity was implemented. The project was implemented through institutional partnership composed of research center, agricultural bureau, nongovernmental organizations, farmers, development agents and cooperative union. The project adopted FFS and FRG participatory approaches in order to assess their roles in bringing attitudinal and knowledge change among hosting farmers. The project implementation proceeded after generating baseline information regarding attitudes and knowledge of farmers and institutions in potato production. As per the approaches, the project provided theoretical and hands on practical training to farmers and other institutions. For FRG, each group formed their own constitutions and designed penalties for any unlawful acts emanating from members in the process of implementing the project.

Sample size selection: Selection of farmers within the weredas was done in consultation with wereda agricultural and rural development office and in collaboration with development agents at respective sites. The selection processes were gender sensitive because potato production, management, post harvest handling and marketing are mainly carried out by women. As a result, a total of 31 women farmers; 5 in Jeldu FFS, 4 in Galessa FFS, 2 in Galessa FRG, 6 in Welmera FFS, 7 in Welmera FRG, 7 in Degam FFS and FRG were involved in the project for three consecutive years. For integrated potato disease management, both FFS and FRG participatory approaches were used. One FFS with 25 members per wereda and three FRG with 5 members per wereda composing a total of 100 farmers in FFS and 60 farmers in FRG were organized and participated in the project.

Data collection methods: In order to identify the role FFS and FRG play in bringing attitudinal and knowledge change among farmers, both FFS and FRG approaches were used to deal with integrated potato disease management. Each of the group was given Jalanie potato variety and fungicidal Ridoml Mancozeb 63.5% Wettable Powder. Fungicide spraying was done either once or twice as appropriate during cropping season. The study used split plot design with three replications in each district; with potato varieties named as Al-624 (susceptible check), International Potato Center (CIP)-386423.13, CIP-392350.516, CIP-392350.516, Kp-90134.2. Fungicide and variety were the main plot and subplot factors, respectively. Each farmer then allocated a plot size of 6×3.75 m and spacing of 0.75×0.3 m inter row and intra row, respectively. Recorded data related to emergence percentage, disease severity, plant vigor, plant height, growth pattern, number of main stem per hill, early blight severity and plant maturity were taken to analyze biophysical aspects. In order to generate attitudinal and knowledge related data, close supervision and monitoring of FFS and FRG at Welmera and Galessa weredas was done. Farmers in these weredas were provided with ware potato store and local potato storage system to compare and contrast the study outcome. In this case, three improved ware potato storage structures were constructed in the two FFS and one in each of the three FRG in each wereda. In addition, trainings were provided to groups and individual at his/her own farm trial plot. Farmers made cross visits among groups and thus shared experiences, expertise, knowledge and attitude. Moreover, intensive trainings for FFS members were provided to capacitate them with technological knowledge and emerging innovations.

In order to identify the role FFS and FRG play in bringing attitudinal and knowledge change among farmers, both FFS and FRG approaches were used to deal with integrated potato nutrient management at Jeldu wereda during off season. Four treatments such as organic fertilizer application, inorganic fertilizer application, combination of organic and inorganic fertilizer and no

fertilizer as a control were used. The study was laid down as Randomized Complete Block with three replications. The team and farmers groups organized weekly to conduct field sessions that mainly focused on soil and nutrient management. The field guide/manual was compiled and used to reduce study errors that occur due to inadequate knowledge on the subject matter. Then compost was prepared and used for demonstration to complement theoretical knowledge that was gained in the course of project implementation process.

Identification of information flow prospects and constraints regarding potato production, management, post harvest handling and marketing was done using agricultural knowledge and information system. The institutions, organizations, groups or individuals and their interactions (linkages) in information and technologies exchange were used to asses changes in attitudes and knowledge. Data related to change in attitudes and knowledge as a result of the interventions was collected using RAAKS (Engel and Salomon, 1997), focus group discussions, semi-structured survey and observation. According to Engel (1997) RAAKS allows system components to be involved in the analysis of current intervention strategies and define their own problem situation and identify potential solutions. Moreover, experienced rapporteurs used laptops to input information, views, knowledge and experiences of RAAKS workshop. In order to assess the change in attitude and knowledge among hosting farmers, a case study data collection method was used. Single case study intends to test already existing theory whereas multiple cases draw conclusions from a group of cases especially when the phenomena under the study exist in varieties of situations, which enhance the generality of the findings (Van de Fliert, 1993; Huberman and Miles, 1994; Stake, 1994). The method is appropriate to learn as much as possible from cases that combine different approaches with different technology types in different contexts. Checklist was prepared and used to guide the facilitator in generating pertinent information.

Methods of data analysis: Data collected were analyzed using statistical packages such as Statistical Package for Social Scientists. In the course of data analysis, descriptive statistics such as mean scores and percentages were used. Moreover, Likert Scale was used to scale farmers' responses in regards to attitudinal and knowledge change. While responding to survey questionnaire, farmers specified their level of agreement or disagreement on a symmetric agree-disagree scale for a series of statements. The five ordered scales that were used include strongly disagree, disagree, neither agree nor disagree, agree and strongly agree. Then each question was separately analyzed.

RESULTS AND DISCUSSION

Table 1 depicts percentage share of attitudinal changes achieved using FFS and FRG in integrated potato disease management. FRG has brought relatively better attitudinal change in scales such as potato has no other uses except for ware after cooking and seed, the knowledge conveyed by the research center is good but difficult to practice, even if working in a group enabled me to access market I work individually, working in a group is a better way to learn but time consuming, there is improvement in traditional way of farming after working with research center, training helped to shift from traditional way of farming and the efforts taken by research center to control pests and diseases was most successful as compared with FFS. This implies that institutional support services such as trainings, conducive learning environment, input provision and demonstration are very important in bringing attitudinal changes among farmers when FRG

Table 1: Percentage share of attitudinal changes using FFS and FRG approaches in integrated potato disease management

	FFS using integrated potato disease management					FRG using integrated potato disease management				
Attitude scales	Strongly disagree	Disagree	No idea	Agree	Strongly agree	Strongly disagree	Disagree	No idea	Agree	Strongly agree
Potato has no other uses than for ware after cooking and seed	36.1	61.1	-	2.8	-	8.7	69.6	-	21.7	-
If i have no enough farm land and am in low capacity, I will give priority for potato	-	5.6	-	75.0	19.4	-	13.0	-	69.6	17.4
I have got knowledge through working with research centers, but no income	22.2	61.1	-	16.7	-	21.7	47.8	-	26.1	4.3
The knowledge conveyed by research centers is good but difficult to practice	33.3	63.9	-	2.8	-	17.4	82.6	-	-	-
Even if working in a group enables to access market, i work individually	13.9	69.4	-	16.7	-	8.7	78.3	-	13.0	-
I have got inputs of farming being in group, which I could not get individually	-	5.6	-	83.3	11.1	-	4.3	-	91.3	4.3
Working in a group is a better way to learn but is time consuming	27.8	69.4	-	2.8	-	8.7	73.9	-	17.4	-
After i have started working in a group, I have got chances to contact different organizations	-	11.1	-	80.6	8.3	-	17.4	-	78.3	4.3
I have improved my traditional way of farming to a large extent after working with research center	-	-	-	52.8	47.2	-	-	-	69.6	30.4
Working in a group saves time and is a better way of learning	-	2.8	-	44.4	52.8	-	4.3	-	69.6	26.1
Working in a group doesn't give equal benefit to all members, because some members try to benefit more at expense of others	2.8	69.4	-	27.8	-	8.7	73.9	-	17.4	-

Table 1: Continue

	FFS using integrated potato disease management					FRG using integrated potato disease management				
Attitude scales	Strongly disagree	Disagree	No idea	Agree	Strongly agree	Strongly disagree	Disagree	No idea	Agree	Strongly agree
I haven't earned equivalent income compared to my participation in a group	11.1	77.8	-	11.1	-	8.7	78.3	-	13.0	-
Training has played a great role for changing our traditional way of farming	-	-	-	58.3	41.7	-	-	-	82.6	17.4
The effort made by research centers to control pests and diseases is most successful	-	-	-	66.7	33.3	4.3	-	-	87.0	8.7
It is possible to prepare more than 10 recipes from potato	2.8	2.8	11.1	55.6	27.8	-	-	8.7	87.0	4.3
Since late blight is caused by the presence of clouds, it is possible to control it by planting potato in its absence	8.3	58.3	2.8	30.6	-	-	47.8	-	52.2	-

approach is adopted. This finding confirms the result of Ismail *et al.* (1995) which concluded that effective institutional support in providing inputs and trainings are precondition for successful FRG but careful in importing outsiders views wholly into FRG processes.

On the other hand, FFS approach brought relatively better attitudinal change than FRG among farmers in scales such as working with research center imparts knowledge but no income, I own enough farm land and in low capacity then I give priority to potato production and since late blight is caused by the presence of clouds, it is possible to control it by planting potato in its absence. This shows that farmers in FFS approach brought attitudinal changes on technical aspects of the study rather than institutional contributions as the case in FRG. According to FAO (2000), FFS has provided a people centered learning approach whereby farmers can learn about and investigate for themselves the costs and benefits of alternative technologies for enhancing farm productivity. Among other things FFS's were designed to improve farmers' analytical and decision-making skills so that in the long run they could influence policy makers. In all the remaining scales, both approaches brought almost similar attitudinal changes among hosting farmers.

Table 2 provides attitudinal change brought among farmers using FFS and FRG in integrated potato nutrient management. The attitudinal change scale indicated that farmers in FFS have brought relatively better attitudinal changes than FRG approach in areas such as if I have enough farm land and am in low capacity I will give priority to potato production, being in a group enabled me to get inputs which I could not individually, working in a group has widen chance to contact different institutions, working with research center helped me to improve my traditional way of farming, working in a group is a better way of learning and saves time, the efforts of research

Table 2: Percentage share of attitudinal changes using FFS and FRG approach in integrated potato nutrient management

	FFS using integrated potato nutrient management					FRG using integrated potato nutrient management				
Attitude scales	Strongly disagree	Disagree	No idea	Agree	Strongly agree	Strongly disagree	Disagree	No idea	Agree	Strongly agree
Potato has no other uses than for ware after cooking and seed	-	75.0	-	25.0	-	33.3	44.4	-	22.2	-
If I have no enough farm land and am in low capacity,	-	5.6	-	86.1	8.3	-	-	-	44.4	55.6
I will give priority for potato I have got knowledge through working with research centers but no income	13.9	80.6	-	5.6	-	27.8	72.2	-	-	-
The knowledge conveyed by research centers is good but difficult to practice	13.9	83.3	-	2.8	-	33.3	61.1	-	-	5.6
Even if working in a group enables to access markets,	19.4	61.1	2.8	16.7	-	27.8	38.9	-	27.8	5.6
I work individually I have got inputs being in a group, which i could not get individually	-	-	-	100.0	-	-	5.6	-	77.8	16.7
Working in a group is a better way to learn but is time consuming	13.9	77.8	-	8.3	-	5.6	66.7	-	27.8	-
After I have started working in groups, I have got chances to contact different organizations	-	5.6	-	91.7	2.8	-	-	-	83.3	16.7
I have improved my traditional way of farming to a large extent after working with research centers	-	-	-	72.2	27.8	-	-	-	44.4	55.6
Working in a group saves time and is a better way of learning	-	2.8	-	55.6	41.7	-	5.6	-	44.4	50.0
Working in a group gives unequal benefit to all members, because some members try to benefit more at expense of others	27.8	72.2	-	-	-	5.6	83.3	5.6	-	5.6

Table 2: Countinue

	FFS using integrated potato nutrient management					FRG using integrated potato nutrient management				
Attitude scales	Strongly disagree	Disagree	No idea	Agree	Strongly agree	Strongly disagree	Disagree	No idea	Agree	Strongly agree
I haven't earned equivalent income as my participation in the group	25.0	41.7	-	33.3	-	11.1	83.3	-	-	5.6
Training has played a great role for changing our traditional way of farming	-	-	-	69.4	30.6	-	-	-	77.8	22.2
The effort made by research centers to control pests and diseases is most successful	-	-	-	80.6	19.4	-	-	-	66.7	33.3
It is possible to prepare more than 10 recipes from potato	-	5.6	19.4	61.1	13.9	-	5.6	22.2	38.9	33.3
Late blight is caused by the presence of clouds and it is possible to control by planting potato in its absence	-	44.4	-	55.6	-	22.2	33.3	-	44.4	-

center to control pests and disease was successful. However, FRG brought relatively better attitudinal change than FFS in scales such as even if working in a group is good to access markets I seek markets individually, working in a group is a better way to learn but is time consuming, training plays a great role in transforming traditional way of farming.

Generally, the two approaches were found to be comparable to bring attitudinal change. When attitudinal changes of farmers for integrated potato disease management and integrated potato nutrient management was compared, better attitudinal change was achieved by integrated potato nutrient management than integrated potato disease management. Yet the attitudinal change brought by farmers in integrated potato disease management for issues such as potato has no other uses except for ware after cooking and seed, if I have no enough farm land and am in low capacity I will give priority for potato production, the knowledge conveyed by research center is good but difficult to practice, even if working in a group is good to access markets I am able to access market individually, working in a group is a better way to learn but is time consuming, I have not earned equivalent income as my participation in a group and late blight is caused by the presence of clouds and it is possible to control by planting potato in its absence was better than the integrated potato nutrient management.

Table 3 gives percentage share of knowledge change among farmers of FFS and FRG in integrated potato disease management. FRG brought relatively better knowledge change than FFS in issues such as well drained, sandy and clay soils are suitable for growing potato, heavy rainfall is conducive for potato production, potato can be grown during the dry season in all areas at any time when frost is absent and major insect pests of potato include tuber moth, cut worm and aphids. On contrary, FFS brought relatively better knowledge change than FRG in scales such as there is

Table 3: Percentage share of knowledge changes using FFS and FRG approach in integrated potato disease management

	FFS using integrated potato disease management					FRG using integrated potato disease management				
Attitude scales	Strongly disagree	Disagree	No idea	Agree	Strongly agree	Strongly disagree	Disagree	No idea	Agree	Strongly agree
It's possible to store ware and seed potato in the same storage	41.7	55.6	-	2.8	-	34.8	60.9	-	4.3	-
Well drained, sandy and clay soils are suitable for growing potato	19.4	63.9	-	16.7	-	17.4	78.3	-	4.3	-
Heavy rainfall is conducive for potato production	38.9	61.1	-	-	-	26.1	56.5	-	17.4	-
Land preparation should done when the soil has some moisture	-	5.6	-	72.2	22.2	-	4.3	-	91.3	4.3
Planting time for potato is determined by availability of rainfall, irrigation water and climatic conditions	-	13.9	-	77.8	8.3	-	13.0	-	82.6	4.3
Potato can be grown during dry season in all areas at any time in the absence of frost	-	16.7	-	66.7	16.7	-	30.4	-	56.5	13.0
Whether tuber sprout is directed upwards, downwards or horizontal while planting, there is no problem	63.9	33.3	-	-	2.8	43.5	56.5	-	-	-
Potato can be planted in all soil types and different moisture regimes at equal depths	30.6	41.7	-	27.8	-	26.1	52.2	4.3	17.4	-
Organic fertilizers are good for potat production but not inorganic ones	50.0	44.4	-	2.8	2.8	43.5	56.5	-	-	-
Single cultivation is enough for potato production	72.2	27.8	-	-	-	47.8	43.5	-	8.7	-
It is imperative to spray Ridoml as soon as late blight symptom	-	-	-	44.4	55.6	4.3	4.3	-	56.5	34.8
Major insect pests of potato include tuber moth, cut worm and aphids	-	-	-	55.6	44.4	4.3	-	-	82.6	13.0

Table 3: Countinue

	FFS using integrated potato disease management					FRG using integrated potato disease management				
Attitude scales	Strongly disagree	Disagree	No idea	Agree	Strongly agree	Strongly disagree	Disagree	No idea	Agree	Strongly agree
There is a technology that can store seed potato tubers for 8-9 months	-	-	-	55.6	44.4	-	4.3	-	82.6	13.0
Ware potato should be stored in storages which do not allow light entry	2.8	-	11.1	50.0	36.1	-	4.3	17.4	65.2	13.0

no problem if the sprout of the tuber is directed upwards, downwards, or horizontally while planting, single cultivation is enough for potato production and the farm land for planting potato should be prepared when the soil has some moisture.

Table 4 provides percentage share of knowledge change among farmers in FFS and FRG approaches using integrated potato nutrient management. FFS approach resulted in relatively better knowledge change than FRG in scales such as the farm land for potato should be prepared when the soil has some moisture, planting time for potato is determined by availability of rainfall, irrigation water and other climatic conditions, ware potato stores should not allow light entry, potato can be planted in all soil types with different moisture regimes at equal depths, potato can be grown during dry season in all areas at anytime in the absence of frost, major insect pests of potato include tuber moth, cut worm and aphids and there is a technology that store seed potato without allowing in light. FRG brought better knowledge change than FFS in issues such as well drained, sandy and clay soils are suitable for growing potato, whether sprout is directed upwards, downwards or horizontal while planting there is no problem and it is imperative to spray fungicide as soon as late blight symptom is observed. In the remaining scales both approaches resulted in almost similar knowledge change. The possible reason for such equal performance to the two approaches could be that some of the issues are well addressed when the number of participates are small and other issues are well addressed when the number of participants are large. Moreover, information exchange among members of the approaches contributed to similar result in knowledge change. The field sessions follow up in FFS approach could be a desirable quality of the approach to tackle some of the problems in the area of knowledge gap.

As compared with each other, there was similar level of knowledge change in the integrated potato nutrient management and integrated potato disease management in issues such as whether tuber sprout is directed upwards, downwards or horizontal while planting there is no problem, organic fertilizers are good for potato production but not inorganic fertilizer, it is imperative to spray Ridoml fungicide as soon as late blight symptom is observed, major insect pests of potato include tuber moth, cut worm and aphids and there is a technology that can store seed potato tubers that do not allow light to pass through. However, integrated potato nutrient management has brought better knowledge change in issues such as well drained, sandy and clay soils are suitable for growing potato, heavy rainfall is conducive for potato production, farmland for planting potato should be prepared when the soil has some moisture, potato can be planted in all soil types and different moisture regimes at equal depths, single cultivation is enough for potato production and

Table 4: Percentage share of knowledge changes using FFS and FRG approach in integrated potato nutrient management

	FFS using integrated potato disease management					FRG using integrated potato disease management				
Attitude scales	Strongly disagree	Disagree	No idea	Agree	Strongly agree	Strongly disagree	Disagree	No idea	Agree	Strongly agree
It's possible to store ware and seed potato in the same storage	14.3	74.3	-	11.4	-	44.4	38.9	-	16.7	-
Well drained, sandy and clay soils are suitable for growing potato	28.6	68.6	-	2.9	-	44.4	55.6	-	-	-
Heavy rainfall is conducive for potato production	37.1	60.0	-	2.9	-	61.1	38.9	-	-	-
Land preparation should be done when the soil has some moisture	-	-	-	100.0	-	-	-	-	55.6	44.4
Planting time for potato is determined by availability of rainfall, irrigation water and other climatic conditions	-	8.6	-	91.4	-	-	38.9	-	44.4	16.7
Potato can be grown during dry season in all areas at any time in the absence of frost	-	20.0	-	80.0	-	-	11.1	-	72.2	16.7
There is no problem if the sprout of the tuber is directed upwards, downwards, or horizontally while planting	45.7	54.3	-	-	-	61.1	38.9	-	-	-
Potato can be planted in all soil types and different moisture regimes at equal depths	14.3	80.0	-	5.7	-	16.7	50.0	-	22.2	11.1
Organic fertilizers are good for potato production but not inorganic ones	51.4	45.7	-	2.9	-	55.6	44.4	-	-	-
Single cultivation is enough for potato production	54.3	42.9	2.9	-	-	66.7	33.3	-	-	-
It is imperative to spray Ridoml as soon as the incidences of late blight disease	-	5.7	-	60.0	34.3	-	-	-	72.2	27.8
Major insect pests of potato include tuber moth, cut worm and aphids	-	-	2.9	82.9	14.3	-	-	5.6	72.2	22.2

Table 4: Countinue

	FFS using integrated potato disease management					FRG using integrated potato disease management				
Attitude scales	Strongly disagree	Disagree	No idea	Agree	Strongly agree	Strongly disagree	Disagree	No idea	Agree	Strongly agree
There is a technology that can store seed potato tubers for 8-9 months	-	-	2.9	94.3	2.9	-	5.6	-	61.1	33.3
Ware potato should be stored in storages which do not allow light entry	-	5.7	20.0	74.3	-	-	27.8	22.2	22.2	27.8

ware potato should be stored in storages which do not allow light to enter into. On the other hand integrated potato disease management has brought better knowledge change in issues such as its possible to store both ware and seed potato in the same type of storage and planting time for potato is determined by availability of rainfall, irrigation water and other climatic conditions. Generally, it implies that those farmers in the integrated nutrient management had achieved more knowledge change in many issues than those participated in integrated disease management.

CONCLUSION AND RECOMMENDATIONS

The findings indicated that participating farmers in the whole process of technology transfer has a pertinent impacts in research for development. Both FFS and FRG promoted farmer participation in potato production, management, post harvest handling and marketing activities. However, the efficiency of the approaches in bringing attitude and knowledge change depended on the type of issues that facilitators dealt with and the way the whole processes were handled. For some of the issues, FRG was found to be more superior to FFS. For some others, FFS was found to be more effective than FRG. Therefore, combining the two approaches should bring better attitudinal and knowledge change as desired than dealing them separately.

In general, even though FFS approach entailed more initial investments than FRG approach, it ensures active participation, more contact and experience sharing among farmers. Previous studies indicated that the group approach was more effective since it promotes collective learning and exchanges that occur in group settings and ensures that more people participate, thus making participatory research cost-effective and relevant to the needs of different categories of farmers. Initial investments on knowledge created favorable conditions to make effective productions in the seasons to come. Given the diversity and complexity of farmers' needs, the more farmers participate in the research process, the better the benefits would be. In FRG approach, the risk was shared but not borne by an individual. The products of the research process are public goods since they could be delivered as locally adapted technologies to a large number of farmers. Therefore, the costs of investment on knowledge are high at initial years of intervention. However, the knowledge transferred to beneficiaries is expected to generate more and more profits in the succeeding seasons of production. Thus, knowledge transfer through appropriate approaches should be promoted to potato producing areas of the country.

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