Farmers' Adoption of Improved Technological Knowledge on Soybean Production in Northern Shan State Area, Myanmar

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ABSTRACT

The objectives of this research were to study: the socio-economic characteristics of farmers and their knowledge of soybean production; extension activities affecting the adoption of improved soybean production technologies; farmers' problems; and recommended alternative solutions. Of the 25,743 soybean farmers in the Lashio , Hsipaw and Kyaukme townships of Northern Shan State 377 were sampled. Data were collected using an interview schedule and were analyzed using frequency, percentages and arithmetic means. A Chi-square test was employed to test hypotheses at the .05 significance level.

The findings revealed that the adoption of improved soybean production technologies was less than 50 percent except for the adoption of improved varieties. Hypothesis testing revealed that adoption was significantly related to: (1) the educational level; (2) family labor; (3) farm income; (4) credit; (5) off-farm employment; (6) farmers' knowledge on soybean production; and (7) extension activities such as home or farm visits, group activities and demonstrations. Major problems of the farmers were: credit, the improved varieties, fertilizers, technical knowledge, and a need for extension activities.

Key words: technology adoption, soybean production, Myanmar

บทคัดย่อ

วัตถุประสงค์ของการวิจัยนี้เพื่อศึกษาปัจจัยด้านสังคมและเศรษฐกิจ ความรู้ของเกษตรกรเกี่ยวกับเทคโนโลยี่ถั่วเหลือง และกิจกรรมการส่งเสริม ที่มีผลต่อการยอมรับเทคโนโลยีการผลิตถั่วเหลือง ปัญหาของเกษตรกรและทางเลือกที่แนะนำในการแก้ปัญหา กลุ่มตัวอย่างประกอบด้วยเกษตรกรจำนวน 377 คน โดยการสุ่มเลือกแบบแบ่งชั้นภูมิจากประชากรจำนวน 25,743 ภายในเขตพื้นที่ Lashio, Hsipaw และ Kyaukme รัฐฉานตอนเหนือของประเทศสหภาพพม่าและมีการใช้แบบสอบถามเป็นเครื่องมือสำหรับเก็บข้อมูล ข้อมูลที่ได้นำมาวิเคราะห์โดยใช้ค่าร้อยละ ค่าเฉลี่ยและใช้การทดสอบไค-สแควร์ที่ระดับนัยสำคัญ .05 เพื่อทดสอบสมมติฐาน

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ผลการศึกษาพบว่าการยอมรับเทคโนโลยีการผลิตถั่วเหลืองที่พัฒนาขึ้นมีน้อยกว่าร้อยละ 50 เว้นแต่การยอมรับในสายพันธุ์ที่พัฒนาให้ดีขึ้น จากการทดสอบสมมติฐานพบว่า การยอมรับเทคโนโลยีการผลิตถั่วเหลืองที่พัฒนาขึ้นมีความสัมพันธ์อย่างมีนัยสำคัญกับ (1) ระดับของการศึกษา (2) จำนวนแรงงานในครอบครัว (3) รายได้ต่อพื้นที่เพาะปลูก (4) เงินกู้ (5) การทำงานอย่างอื่นนอกเหนือจากการเพาะปลูก (6) ความรู้ของเกษตรกร และ (7) กิจกรรมการส่งเสริมต่าง ๆ เช่น การไปเยี่ยมชมบ้านหรือสถานที่เพาะปลูก กิจกรรมกลุ่ม และการสาธิต ปัญหาสำคัญของเกษตรกรคือ เงินกู้ สายพันธุ์ที่พัฒนาแล้ว ปุ๋ย ความรู้ทางด้านวิชาการ และกิจกรรมการส่งเสริมที่จำเป็น

คำสำคัญ: เทคโนโลยีการยอมรับ, ผลผลิตถั่วเหลือง, สหภาพพม่า

INTRODUCTION

Soybean was grown in Myanmar for local consumption in former times (MAS, 2001). In the 1970s, there was low production and also low yield due to the growing of a local cultivar which was thermo-and photo-sensitive. Therefore exotic varieties have been introduced since 1991. Although high-yield varieties have made a change, technological transfer is weak and also production is low (Moe, 1993).

Soybean is grown in both rainy and cool seasons. Based on seasonal production statistics, areas planted with soybean in the cool season account for 57 percent of the total. In the rainy season, the hill region has the largest sown areas in the country, especially in Southern and Northern Shan State (Kyi, 2003). Nowadays, soybean is a popular crop in Myanmar. The crop covers about 153,000 ha, mainly grown in the Shan State area (42 %), the Mandalay Division (21%), the Sagaing Division (13%) and the Ayeyarwaddy Division (7%) with an average yield of 1.17 tonnes per ha (DAP, 2006).

In 2000, soybean was the main crop grown for poultry farm and aqua cultural feed in domestic markets. It has become a crop with high potential with additional utilization for soybean oil and soybean cake according to market surveys.

There are two ways of the improving soybean production (MAS, 2004): either by extending the area; or by increasing the yield per unit area. Area extension is not favored because of limitations such as the prohibition on shifting cultivation and competition with crops of the summer paddy and vegetables. Thus there is a need to increase the yield per unit area. This is affected by several production factors including low yield per ha, high cost of production and inappropriate uses of inputs such as seeds, chemical fertilizers and pesticides. In addition the price obtained by the farmers and rate of return are low. If soybean production in hilly regions is to increase, there will be need to improve technologies and varieties. Therefore, there is a need for knowledge on farmers' behavior on the adoption of improved soybean production technologies in Northern Shan State.

STATEMENT OF THE PROBLEM

The demand for soybean has increased because of natural value, oil requirements and economic aspects. Therefore there was a need to study the cause of low yield and benefits, production constraints, competitive crops and appropriate research issues to address such problems, improve the soybean varieties grown and identify the desirable characteristics of soybean and those preferred by the farmers.

The Oil Crops Development Project in Myanmar recommended research on soybean as it is an attractive crop to grow as replacement crop and it also benefits subsequent crops. However, very little research has been done to understand the adoption behavior of farmers and problems encountered in the adoption of innovation, different extension

activities used with farmers and available sources of information.

Therefore, there was a need to study the adoption behavior of soybean farmers to help improve planning for research and development. Knowing the factors which have determined the adoption in the past and the social characteristics of farmers should assist in obtaining quick and wide adoption in the future (UTF/MYA/006/MYA).

In this regard, the study needed to answer the following questions: What are the socio-economic characteristics of different farm families in Northern Shan State (Lashio, Hsipaw and Kyaukme Township)? What are the socio-economic characteristics related to improved technologies? How different is the knowledge of the farmers in adopting the improved technologies? How do farmers participate in extension activities for soybean production? Why do they adopt certain package technologies partially or fully? Why do farmers who adopt the improved varieties and technologies not get the expected yield? What are their suggestions to overcome the problems?

The objectives of the study were to:

1. study the socio-economic characteristics of different households in Lashio, Hsipaw and Kyaukme Township of Northern Shan State;

2. determine the farmers' knowledge on improved soybean production technologies;

3. determine the farmers' participation in extension activities toward the adoption of improved soybean production technology;

4. determine how the farmers decided to adopt the improved soybean production technologies;

5. investigate the relationships between socio-economic characteristics, farmers' knowledge on improved soybean production technologies, participation in extension activities and the farmers' adoption (in the Lashio, Hsipaw and Kyaukme townships) of improved soybean production technologies.

6. identify the problems faced by farmers and obtain their suggestions and alternative solutions to increase adoption of improved technology in soybean cultivation.

LITERATURE REVIEW

An innovation is an idea, method or object which is regarded as new by an individual or other unit of adoption. Adoption is a process of an individual mind. Adoption of an innovation means the process by which a particular farmer is exposed, considered and finally rejects or practices a particular innovation. The degree of adoption in an individual is related to his social status based on his income, education, and occupation, the so-called status dimension. All individuals in a social system do not adopt an innovation at the same time. They adopt an innovation in an ordered time sequence with the time dimension involved in the adoption process.

Mosher (1978) indicated that the process of the adoption of innovations composed of five successive steps: (1) awareness, (2) interest, (3) evaluation, (4) first trial, and (5) either repeated use or rejection.

1. Awareness: The first step towards adoption of an innovation, obviously, is to become aware that it exists. More is involved here than just hearing about it, for one can hear something without believing it. Hence, result demonstration may be called for even at this first step towards adoption.

2. Interest: The second step is to become personally interested. The critical difference between awareness and interest is that, this second step of becoming actively interested occurs when a person comes to believe that innovation might be positive for him.

3. Evaluation: Once a farmer has become interested in an innovation, he begins the process of evaluating it, and of deciding whether or not he wishes to try it. Evaluation is also partly a matter of getting more information about the practice and making a mental trial of the innovation.

4. First trial: The fourth step is actual trial on the farm. In order to take this step, the farmers must collect the required inputs, learn any new skills that are required, commit some land, labor, and money to trial and see what happens.

5. Either repeated use or rejection: Not until a farmer begins to use an innovation, the second, third, fourth time can be said to have "adopted" it. Up to then, he is only getting increasingly interested and experimenting, first imagination and then in fact. Only repeated use indicated that the adoption has taken place. In many cases, after trying an innovation once or perhaps twice, farmers rejected it and never try it again.

In other study, Mendis (2005) studied the factors affecting adoption of recommended crop management practices in paddy cultivation in Kulutara District, Sri Lanka. The study revealed that adoption of soil fertility improvement and sustenance practice was significantly related to education, land, income, credit, sources of information, extension activities and visit, and membership in farmers' organization; and adoption of fertilizer management practices were significantly related to education, land tenure, income, source of information, extension activities and visits and membership in a farmers' organization. Furthermore, adoption of cultural and preventive weed control practices were significantly related to land, income, credit, source, of information, extension activities, and extension officer's visits; and adoption of herbicides recommendations were significantly related to land and income. Moreover, insect pest management practices were significantly related to land tenure, income, sources of information, extension activities, extension officer's visits and membership in a farmers' organization.

Masavisuthi (2005) studied the farmer's adoption of sunflower technology under extension and development project. This research revealed a moderate of knowledge about the sunflower production among the farmers and their adoption of sunflower production technology was at the low level. The socio-economic factors were significantly correlated with adoption of sunflower production technology including education, secondary income of farmers and income. The knowledge about sunflower technology factors were significantly correlated with the adoption of sunflower technology. On the other hand, the more knowledge the farmers have, the higher level of adoption in sunflower production technology.

RESEARCH CONCEPTUAL FRAMEWORK

The research conceptual framework indicated the relationship between socio-economic characteristics, farmers' knowledge, participation in extension activities and adoption of improved soybean production technologies (Figure 1).

METHODOLOGY

Data collection procedure

There were 25,743 soybean farmers using about 15,306 hectares in Lashio township consisting of Malhan and Lashio gyi village groups, the Hsipaw township of Samsal and Samphate village groups and the Kyaukme township of Myinetine and Naungpain village groups (MAS, Northern Shan State, and 2005 Report). Stratified random sampling was used to draw samples for data collection. Six target areas out of 34 were selected with a population of 6,436 soybean farmers. The sample size, allowing for 5 percent error margin, was calculated using the method of Yamane (1973), and resulting in 377 samples.

The interview format was tested with 20 farmers before the study and minor changes were made in interview schedules. Data were collected during April and May 2008 and were analyzed using frequency, percentages and arithmetic means. A Chi-square test was employed to test hypotheses at the .05 significance level.

RESULTS AND DISCUSSION

General background of farmers

Age of the farmers in the study ranged from 25 to 80 with an average of 52 years. Fifty-eight percent had finished primary education (grade 5) or lower while only 20 percent had completed education

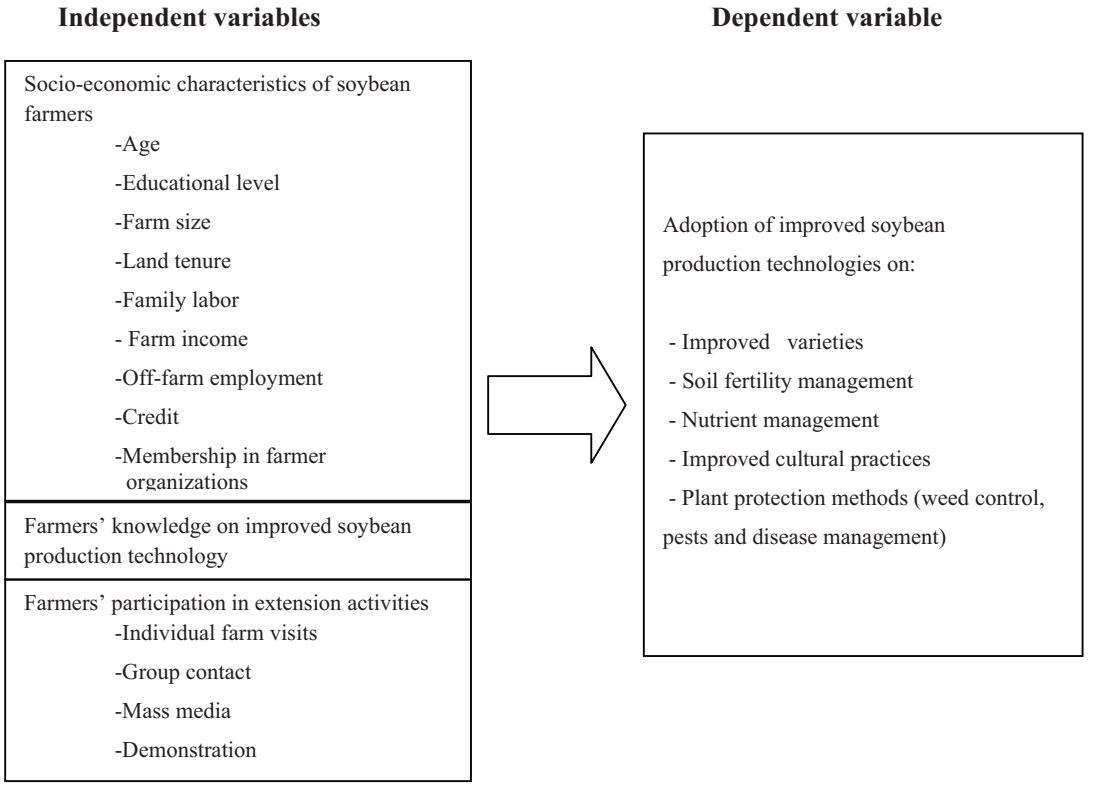

Figure 1 Research conceptual framework

to above grade 5. The farmers were small scale and 88 percent of them owned the land with an average of 0.64 ha. With 42 percent of the farmers owned small farm size of 0.5 ha or less, while 58 percent owned more than 0.5 ha. Eight-eight percent of the farmers in the study cultivated soybean on their land while 12 percent were tenant farmers. Eighteen percent of farmers had two active family laborers, with (72%) having more than two, resulting in an average of three laborers for soybean cultivation.

The maximum total gross annual farm income in 2006-2007 was 637 US$ and 173 US$ minimum, producing an average farm income of 321US$ per ha. Of the soybean farmers, 29 percent were employed in other occupations in addition to farming with 71 percent of farmers not working in another occupation. Credit in the 2007-2008 growing season was not obtained by 67 percent of the farmers, while 33 percent obtained credit from different sources. In this study, the majority farmers (63%) were nonmember of a farmers' organization and 37 percent of the farmers were members of a farmers' organization (Table 1).

Farmers' knowledge on improved soybean production technologies

Knowledge of the farmers was measured by asking 10 questions related to improved soybean production technologies. The total score for 10 questions ranged from 0(zero) to 24, with results classified into three levels using the class interval of Harshbarger, (1977). The reliability coefficient of farmers knowledge questions was .614.

Thirty-two percent of the farmers had a high score level of knowledge (17-24) on improved soybean production technologies, while 55 percent had a medium score level of knowledge (9-16) and 13 percent had a low score level of knowledge (0-8).

Table 1 Socio-economic profile of farmers of the northern Shan State

n= (377)

Socio-economic factors	Number	Percent
Gender		
Man	248	65.78
Woman	129	34.22
Age of farmers		
Under 35 years	73	19.36
35-45	119	31.56
46-55	112	29.72
Above 55 (Max = 80, Min = 25, Average = 52)	73	19.36
Farm size(ha)		
0.25 ha and less	14	3.71
0.26 to 0.50	145	38.46
Above 0.5 (Max = 4, Min = 0.03, average = 0.64)	218	57.83
Education level		
Non -Education	82	21.75
Grade 5 or less	219	58.09
Grade 6-9	63	16.71
Grade 10-11	12	3.18
Above grade 11	1	0.27
Land tenure		
Owner	331	87.80
Tenant Farmers	45	11.94
Joint Owner	1	0.26
Family labor		
Non supporter	38	10.08
1-2 supporters	66	17.51
Above 2 supporters (Max = 8, Min = 0, Average = 3)	273	72.41
Farm income (US$/ha)		
173 - 230	112	29.71
231 - 346	115	30.50
Above 346 (Max = 637, Min = 173 , Average = 321)	150	39.79
Off farm employment		
Employed	109	28.91
Non employed	268	71.09
Credit		
Obtained	123	32.63
Not obtained	254	67.37
Membership in Farmers Organization		
Member	141	37.40
Non member	236	62.60

High score-level farmers had knowledge about improved soybean production technologies such as using the improved soybean varieties, soil fertility management practices, nutrient management practices, improved cultural practices, plant protection methods and target yields for soybean production. Medium score level farmers had knowledge about improved soybean varieties, soil fertility management practices except for liming, using the chemical fertilizers except for using the foliar spray and rhizobium, improved cultural practices and pests control. Low score level farmers had knowledge only of incorporating cow dung, using chemical fertilizers such as Urea, Tsuper and compound fertilizers, appropriate time of sowing, water management, harvesting in time and weed control (Table 2).

The most prominent source of information on improved soybean production technologies were from farmers (62.60%) followed by extension agents and research station 35.28 percent and 2.12 percent, respectively.

Extension activities

It was found that about 3 out of 5 farmers of the study (62.33%) never met the extension agents while 33.69 percent had met 1-3 times and only 3.98 percent had met the agents more than 3 times during the 2007-08 soybean cultivating period.

More than half (51.46%) of the farmers had never attended group activities organized by extension agents while 32.36 percent of farmers had attended only one time, 11.14 percent had attended 2-3 times and only 5.04 percent of the farmers had participated more than three times in discussion and training.

With regard to mass media contact, the result revealed that 95.23 percent of the farmers never listened to audio (radio, audio cassettes) while 97.1 percent of the farmers had never watched video (television, film and video) and 68.44 percent never read any printed materials (posters, newspapers, leaflets).The farmers in the study had least contact with extension mass media, while the neighboring farmers played an important role in dissemination of knowledge and information for farmer acceptance of soybean production technologies.

In this study, extension agents demonstrated methods to 27.32 percent of the farmers and 72.68 percent received none. The results demonstration methods were shown to 3.18 percent of farmers with 96.82 percent not participating in these activities (Table 3).

Adoption of the improved production technologies

The innovation-decision process describes the steps through which an individual (or other decision unit) passes from gaining initial knowledge of an innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision. The process consists of a series of action related to new ideas and choices over time through which an individual system evaluates new ideas and decides whether or not to incorporate the innovation into the ongoing practice. This behavior consists essentially of dealing with the uncertainty that is inherently involved in deciding about a new alternative compared to those already in existence. The perceived newness of an innovation, and uncertainty associated with this newness, is a distinctive aspect of innovation decision making, (compared to other types of decision making) (Roger, 2003).

An individual's decision to adopt innovation is determined by many factors: socio-economic factors, resources, personal values, profitability, suitability. Characteristics of the decision making unit- socio-economic characteristics, personality variables and communication behavior, play a major role in the adoption process. Rogers (1995) further indicated that persuasion stage of the adoption process of an individual is influenced by perceived characteristics of the innovation: relative advantages, compatibility, complexity, trialability and observability.

The current study found that 51.46 percent of the farmers cultivated improved varieties such as SB45, SB 60, CPS1, Yezin and China varieties while

Table 2 Farmers' knowledge on improved soybean production technologies

n= 377

	Knowledge of improved technologies	Correctly answer farmers		Incorrectly answer farmers	
		no.	%	no.	%
1.	Improved soybean varieties were				
	(1) SB45, SB60,Yezin and china varieties	257	68.17	120	31.83
2.	Improved soybean varieties were				
	(2) high yield	248	65.78	129	34.22
	(3) adaptable to region	212	56.23	165	43.77
	(4) resistant to pests and diseases	144	38.20	233	61.80
3.	Soil fertility management practices were				
	(5) incorporate of cow dung, green manure	295	78.25	82	21.75
	(6) incorporate of liming	8	2.12	369	97.88
	(7) summer ploughing and deep ploughing	216	57.29	161	42.71
4.	Recommendations for improvement of soil fertility practices were				
	(8) incorporate 3 tons /ha of cow dung and 1 ton of green manure and composes	287	76.13	90	23.87
	(9) incorporate 1 ton of lime	3	0.79	374	99.21
5.	Nutrient management practices were				
	(10) Use of natural fertilizers	221	58.62	156	41.38
	(11) use of appropriate chemical fertilizers (Urea, Tsuper, Potash and compound)	250	66.31	127	33.69
	(12) use of foliar fertilizers (bio super)	44	11.67	333	88.33
	(13) use of rhizobium	4	1.06	373	98.94
6.	Recommendations for using the chemical fertilizers were				
	(14) Urea (65 kg), Tsuper(130 kg) and Potash (65 kg) or compound (100 kg) per ha	222	58.89	155	41.11
	(15) 3 liters per ha of foliar fertilizers	44	11.67	333	88.33
	(16) 10 gm per ha of rhizobium	4	1.06	373	98.94
7.	Improved cultural practices were				
	(17) line sowing	199	57.79	178	47.21
	(18) the best time for pre-monsoon planting January to end of March	247	65.52	130	34.48
	(19) seed rates (70-80 kg per ha)	240	63.66	137	36.34
	(20) good harvesting time (95% of pod maturity stage)	220	58.36	157	41.64
	(21) watering after sowing and seeds setting times	168	44.56	209	55.44
8.	If pests and diseases problems happen in the field, important cultural practice was				
	(22) any steps to control pests and diseases	183	48.54	194	51.46
9.	If the weeds problems happen, important cultural practice was				
	(23) timely inter cultivation weeding	172	45.62	205	54.38
10.	Target yields for soybean production was				
	(24) 50 baskets per ha	176	46.68	201	53.32

Table 3 Farmers' participation in various extension activities

n=377

Items	Individual		Group		Mass media						Demonstration			
	Contact		Contact		Sound		Moving picture		Print		Methods		Results	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
One time	81	21.49	122	32.36	18	4.77	11	2.92	109	28.9	93	24.66	12	3.18
2-3 times	46	12.2	42	11.14	0	0	0	0	10	2.65	9	2.39	0	0
Above 3 times	15	3.98	19	5.04	0	0	0	0	0	0	1	0.27	0	0
Never	235	62.33	194	51.46	359	95.23	366	97.1	258	68.4	274	72.68	365	96.82

48.54 percent cultivated local varieties such as Naung pit, Hto Naung and Hto Laine (Local names). Farmers mentioned high yield, better response to fertilizers, maturation time and more profit as reasons to adopt the improved varieties. High cost of cultivation, high fertilizer requirement, pest and disease problems were as reasons to reject the improved varieties. Less pest and diseases and suitable soil were the main reasons to grow the local varieties.

About 1 in 5 farmers (20.95%) adopted soil fertility management, while 79.05 percent did not. The main reasons for adoption were due to long-term benefit, improvement of soil fertility, less pest and disease damage, improvement of response to fertilizers and thus an increase in yield. Cost of time, scarcity of organic matter and no time were the main reasons for non adoption.

This study revealed that 13.79 percent of the farmers adopted nutrient management while 86.21 percent did not. The main reasons for adoption were due to increase yield and profit. Financial difficulties and misconceptions of farmers were the main reasons for non adoption.

According to this study, 39.26 percent of the farmers adopted improved cultural practices and 60.74 percent of farmers did not. Farmers revealed that better plant growth, ease of harvest and increased seed yield were main reasons for adoption. Not enough moisture, labor shortage and not getting seed in time were the main reasons for non adoption.

This study revealed that 19.40 percent of the farmers adopted weed control while 80.60 percent did not. Farmers mentioned less weeds, better growth and increased yield as reasons for adoption. Labor shortage, financial difficulties and difficulty in buying herbicide were the main reasons for non adoption.

According to the study, 24.69 percent of the farmers adopted pest and disease management while 75.31 percent of farmers did not. Farmers mentioned good plant growth, increased yield and profit as main reasons for adoption. High cost of control, lack of technicians and religious views were the main reasons for non adoption (Table 4).

Relationships between adoption of improved soybean production technologies and the independent variables

Chi-square test results at the .05 level of significance revealed that there was no statistical significance among age of famers, farm size, land tenure and membership in farmers' organization and farmers' adoption of improved soybean production technologies.

Among the 14 selected factors of study, education level, family labor, farm income, off-farm employment, credit, knowledge on soybean production technologies and participation in extension activities were associated with farmers' adoption at the .05 level of significance (Table 5).

The results of the hypothesis testing revealed that farmers having higher education than grade 5 were more likely to adopt technology. Once a farm family had more than two family labor units, they became more receptive to the adoption of the technology. Farmers with farm income above 346 US$, were more likely to adopt the technology; while

Table 4 Adoption of improved soybean production technologies of the sample farmers

Improved soybean production technologies	Adoption of improved soybean production technologies			
	Adoption		Non adoption	
	no	%	no	%
Use of improved varieties	194	51.46	183	48.54
Soil fertility management practices	79	20.95	298	79.05
Nutrient management practices	52	13.79	325	86.21
Improved cultural practices	148	39.26	229	60.74
Plant protection methods				
-weed control	72	19.40	305	80.60
-Pest/diseases control	93	24.69	284	75.31

Table 5 Factors associated with the farmers' adoption of improved soybean production technologies

n=377

Cluster	Selected factors	Improved soybean production technologies (χ^2)					
		1	2	3	4	5	6
Personal/social characteristics	Age	2.344	6.602	0.588	0.858	2.207	4.052
	Education level	18.995*	25.123*	9.943*	6.975	9.667*	9.198*
	Farmer organization membership	3.014	0.359	0.09	0.101	0.02	0.121
	Knowledge on improved soybean production technologies	7.377*	21.344*	14.377*	0.303	8.415*	5.736
Economic status	Family labor	3.318	7.083*	11.250*	4.051	5.913	8.970*
	Land tenure	1.527	4.042	4.042	2.99	3.719	2.769
	Farm size	0.195	1.433	0.579	5.446	0.298	2.460
	Farm income	5.6	3.801	1.457	11.891*	0.121	1.775
	Off-farm employment	13.313*	9.122*	4.393	0.461	1.217	1.603
	Credit	0.360	0.617	0.934	4.449*	1.575	2.072
Extension activities	Home and farm visits	8.728*	18.040*	44.954*	0.005	5.021*	5.019
	Group contact	4.581*	11.013*	16.906*	0.832	3.416	0.107
	Mass media access	1.05	0.025	0.196	2.203	0.465	0.481
	Demonstrations	2.393	0.147	0.78	2.983	5.135*	0.03

Remarks: ns= Non-significance * = Significance at the .05 level $p < .05$

1= Use of the improved varieties

2= Soil fertility management practices

3= Nutrient management practices

4= Improved cultural practices

5= Plant protection methods(weeds control)

6= Plant protection methods (pests and diseases control)

famers who had a chance to work in off-farm employment could get the extra money and were also likely to use the income for input and services. One of the important factors was credit which was necessary for poor farmers, to adopt the technology, and this was pointed out by the conceptual study.

The results of the study indicated that farmers possessing a high level of knowledge adopted the package technologies more than farmers with medium and low level of knowledge. It was found that the wide gap between knowledge and adoption was narrowed if farmers had more knowledge.

According to the study results, extension activities such as individual farm and home visits and group contact methods were effective in helping farmers to adopt the technologies. In addition, results and methods demonstration were interesting to farmers but mass media was a poor form of communication to farmers.

CONCLUSION AND RECOMMENDATIONS

Farmers' adoption of improved soybean production technologies was less than 50 percent except for improved varieties. Hypothesis testing using a Chi-square test revealed that there were significant relationships among farmer's education level, family labor, farm income, off-farm employment, credit, knowledge of the farmers on improved soybean production technologies and participation in extension activities and farmers' adoption of improved soybean production technologies.

Recommendations were presented as follows:

1. There should be on-farm experimentation and local verification trials to find appropriate technologies for the farmers and establish research-extension and a farmer-linkage system or network for knowledge and information sharing for the benefit of small scale farmers in Northern Shan State.

2. A micro credit program should be created to assist the farmers' adoption of improved soybean production technologies.

3. Self- help approach and mutual assistance principles should be practiced to help farmers conduct sustainable farming to increase the adoption of improved soybean production technologies.

4. To improve farmers' knowledge, the Extension Institution should classify objectives and information and extension problems needs according to the target audience level of knowledge, attitude and practices (KAP) and encourage the farmers to increase the adoption of improved technologies in an appropriate manner.

5. Incentives should be provided to the extension officers especially training and capacity strengthening program, transportation facilities and support to facilitate their performance for the benefit of the farm families.

6. Close technical advice and support should be provided consistently to help farmers solve agricultural problems encountered and to improve farming practices to reduce risk and increase productivity.

7. Effective mass media should be developed and translated into clear and practical terms using local languages to improve soybean production technologies.

8. Farmers' organization should be empowered with active involvement of farmers in the decision process, sharing of farming experience and information and also resources should be emphasized and techniques practiced for the benefit of the farmers, individually and in groups. Farmers networks should be developed for the mutual assistance and support toward productive and sustainable development.

9. Greater ease of selling soybean produce within the regional markets with suitable marketing system with private merchants or cooperative societies or government agencies would lead to more adoption of improved soybean production technologies.

Finally it is necessary to increase the farmers' adoption of improved technologies in soybean production for soybean development in Northern Shan State, Myanmar.

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