ECONOMIC ASPECTS OF SOYBEAN GROWERS : THE SYGAP EXPERIENCE[1/]

Abstract

The Soybean Yield Gap Analysis Project Phase II (SYGAP II) carries out on-farm research focuses on constraints faced by farmers who want to adopt research findings to increase their soybean production. During the Project life (1989-1991), the study was undertaken through cooperation between the Ministry of Agriculture and Cooperatives and the CGPRT Centre. On-farm trials were the viable pathway to solve farmers' problems and the meaningful dissemination of the SYGAP team's experience to farmers' decision in the adoption of the package of technology (POT). The findings reported on the testing of POT versus existing farmers' practice indicated that farmers who followed all stages of POT were able to attain a better yield but at a higher cost per unit weight. There appear a considerate points to carry on an additional on-farm trials and demonstration plots. Then the national team decided to readjust the POT with a set of proper land preparation techniques and appropriate kind of fertilizer during the last two years of the Project and to come up with a possible choices of cost reduction while maintaining the yield level. The outcomes showed satisfactory results for economic returns. The input package recommendation may include the application of planters, either inverted-T seeder or hand pull planter, and the change of fertilizer grade from 12-24-12 to 16-20-0 under the test condition in Chiangmai.

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I. INTRODUCTION

The Soybean Yield Gap Analysis Project (SYGAP) in Thailand has been initiated in 1988 to study the existence and to quantify the soybean yield gap. Preliminary survey was conducted in 1987 in six major soybean producing provinces, namely; Nakornsawan, Kamphaengphet, Sukhothai, Uttaradit, Chiangmai and Loei. The study did reveal the fact that yield gap between farmers' field and regional trails was approximately 50% in which the difference in rainy season was greater than in dry season (1:1989). To narrow down the gap the following efforts were suggested (1) good crop management especially land preparation and drainage, (2) efficient pest management, (3) optimum levels of production inputs, (4) knowledge and efforts from government officers, and (5) government policies and measures to help farmers to get reasonable prices.

In the second year of the Project (1989), the study on socio-economic constraints on the soybean grower was undertaken through cooperation between the Ministry of Agriculture and Cooperatives (MOAC) by the three Departments (Department of Agriculture, Department of Agricultural Extention and Office of Agricultural Economics) and the CGPRT Centre in order to identify problems and constraints emerging from farming practices, socio-economic factors and their interrelationship, and to make recommendations to increase soybean yield. The study site was the Mae Tang District in Chiangmai. Two sample groups, each of five farmers, were used to demonstrate the relative merits of a technology package (free seed, fertilizer and pesticide inputs) versus free recommendations (advice only, without free inputs.) The study revealed that the farmers who received free inputs were able to obtain higher yields than those who received free recommendation (234 kgs compared with 173 kgs per rai). The two groups generated net profits of 370 and 330 baht per rai, respectively, Both received their family labor at a rate higher than the local wage of 40 baht per day. The first group increased their returns up to 34% of the invested capital. However, the latter received highers up to 52% on capital invested. The difference in performance between the two groups reflected some degree of risk aversion, commitment to increase productivity and dependence on the source of funds. The study results were assessed using economic returns and farm management practices as measures. Continuing problems of drainage, water management and weed control were identified (2:1990).

The second SYGAP location was in 4 districts in Sukhothai, Srisamrong, Sawankalok, Srinakorn, and Srisatchanalai. The same approach of study on the provision of package of technology (POT) was conducted. In terms of yield performance, the POT provided better yield more than 50% in Srisamrong and Sawankalok, but only 7% and 4% were found in Srisatchanalai and Srinakorn, respectively. The unit cost analysis of POT showed that all locations, except Srisamrong, increased the unit cost of applying the POT than their actual cultivation (3:1990)

Progress made during the Project life (1989-1991) by national SYGAP team and the CGPRT Centre in the attempt for productivity improvement by via of introducing package of technology (POT) to sample farmers shows that significant improvements and farmers'acceptance can be achieved in soybean production in terms of higher and more stable yield. At the same time, after the first year of implementation and monitoring, the Project also aims to sustain the yield levels and looks forward to reducing production cost from the on-farm POT trials and demonstration plots. Only through intersifying activities and input applications -with proper land preparation techniques and appropriate kind of fertilizer- can hope to possibly reduce costs along with maintaining yield level.

On-farm trials are a viable pathway to solve the farmers' problems and the meaningful dissemination of the SYGAP team's experience to farmerss' decision in the adoption of the packages. Several pieces of information were conducted in the farmers' fields during the years, including techniques of land preparation, the use of simple planting tools and the kind of fertilizer.

II. PURPOSES

The main purposes of this report is to determine the economic costs and returns of several on-farm trials of input packages. In specific, two of the processes are underway to be addressed:

(1) to appraise the possible choices of input packages from the on-farm trials, and

(2) to identify problems and constraints, if any, affecting the sample farmers' decision on input package.

III. IDENTIFICATION OF INPUT PACKAGES : THE ON-FARM DESIGNS

(1) The 1990 on-farm Experiment on Planting Technique and Weed Control.

The experiment was conducted with 6 farmers, 2 replications each, in Sanpatong district, Chiangmai. The experimental design was split-split plot with fields burning and not burning as main plots. Planting techniques- conventional bamboo dibbling and inverted-T seeder- were sub plots, and three types of weed control -mulching, post emergence and no weeding- were sub-sub plot.

(2) The 1990 On-farm Demonstration on Planting Technique and the Effect of Field Burning.

Twenty farmers in Hang Doong and Sanpatong districts, Chiangmai were volunteered for 6 treatments in Randomized Complete Block (RCB). Planting techniques were the same as (III-1) as tested factors. The effects of rice straw being burned, not burned (as is) and mowed (or cut) were the other tested factors associated with planting techniques.

(3) The 1991 ON-farm Experiment on Fertilizer, 16-20-0

The experiment was conducted in Sansai district. The design was split plot with fertilizer applications - at planting time and 32 - day after planting- as main plots and 5 levels of 16-20-0, - at the rates of 7.5,15,30,60 and 90 kg/rai-, and two treatments on no fertilizer and 25 kg/rai of 12-24-12 as sub plot.

(4) The 1991 On-farm Demonstration on Planting Techniques

Seventeen farmers in Hang Dong and Sanpatong districts were assigned with three planting techniques - conventional bamboo dibbling, bicycle wheel, and hand-pull planter in the RCB design.

IV. RESULTS - THE ESTIMATED COSTS AND RETURNS

(1) The 1990 On-farm Experiment on Planting Techniques Weed Control and the Effect on Field Burning.

The result of FCRC's experiment in Sanpatong District showed a promising use of inverted-T seeder over the conventional dibbling in the attempt to solve the problem of labor shortage during the planting time and to reduce the production cost per unit area. By this application, the labor cost for planting could be saved for by 115 B/rai (719 B/ha). In addition, the seed rate reduced from 17.4 kg/rai to 13 kg/rai.

The effect of field burning under the application of inverted-T seeder gave better yields and higher net returns than the conventional dibbling for a pair-wise comparison among typer of weed control :- mulching, post emergence, and no weeding. In the same token, the treatment on the effect of no burning technique and post emergence brought about the same conclusion on yield and net return on the benefit of introducing inverted-T seeder.

Weed control by means of herbicide (Persuit) application provided higher yield than no weeding. The mulching technique is an ideal one for the sack of completeness of the experiment since it requires extra rice straw from outside and additional labor work to cover the field. The extra cost for applying herbicide was 145 B/rai (906 B/rai). However, the returns from additional yield increase could not offset the herbicide cost, except for the treatment of inverted-T with no burning.

Therefore the best operating solution for maintaining the yield level at 300 kg/rai (1,875 kg/ha) from the input package with the highest net return of 693 B/rai (4,331 B/ha) was the introduction of inverted-T seeder with field burning and no weeding (Table 1). This treatment provided not only the lowest cost/highest operating capital return but also reaching the target of yield sustainability.

(2) The 1990 on-farm Demonstration on Planting Technique and the Effect of Field Burning.

The on-farm demonstration conducted on 20 farmers' fields. The post emergence was provided as part of the input package. The mulching technique was discarded as tedious activity. The land preparation was tested for field cutting-burning, field cutting only, and no cutting-burning, Then, the planting techniques, inverted-T versus dibbling were applied.

The economic result had confirmed the use of inverted-T with field burning as a mean to reduce cost from the existing farm dibbling technique. The farmers could save both family labor and operating capital as mentioned previously. The overall cost saving was 176 B/rai (1,098 B/ha) and additional return of 226 B/rai (1,414 B/ha) was gained when they applied the inverted-T with field burning (Table 2).

(3) The 1991 On-farm Experiment of Fertilizer, 16-20-0.

Referring to the first year implementation of the Project, It was assigned a set of package of technology to the sample farmers to be tested. One important input, namely, fertilizer 12-24-12, was included as one input recommendation in the set. The result showed satisfactory yield response on one hand, but gave the higher cost which was not a desirable one in return. Kinds of fertilizer application were, therefore, conducted hand in hand right after the experiment. It was found that most of the interviewed farmers, 50% out of the 240 farm samples, applied 16-20-0. The project, then decided to conduct the economoical use of this fertilizer as part of the improved input package. Under the assumption, the POT must be appropriate and accepted by farmers. Besides, the POT must be simple, low cost, less risk and easily found in the marketplace.

(i) Stepwise yield responses. The 16-20-0 fertilizer rate of 30, 60 and 90 kg/rai and 12-24-12 at the rate of 25 kg/rai showed the same level of output of 426-429 kg/rai (2,680 kg/ha) compared to 368 kg/rai (2,300 kg/ha) of no fertilizer use.

(ii) The desirable level of 16-20-0 should be 7.5-30 kg/rai. The net returns will range from 1,078 B/rai to 1,091 B/rai (6,738 -6,819 B/ha) as shown in Table 3.

(iii) The existing use of 16-20-0 by farmers has shown to fall into this range as well. The average level of 16-20-0 application was 23 kg/rai (141 kg/ha) among farmers' planted area who applied only 16-20-0 and became 11 kg/rai (68 kg/ha) when averaging by total planted area.

(4) The 1991 On-farm Demonstration on Planting Techniques.

The inverted-T seeder was left aside in Chiangmai for the reasons that it should attache to the two-wheel tractor and operate in a larger field plot size as those farmers who apply successfully in the lower north of Thailand, particular in Sukothai. Under the rice-soybean base in Chiangmai, the occupied land is rather small and consists of several bundles, the machine operation is not as that convenient and rather time consuming to do the work neatly. The hand pull planter and simple drilling tool, bicycle wheel, introduced to be operated properly for smaller plot size

The set of on-farm demonstration showed a break-even of cost and return for hand pull planter and gave negative returns of loss to the applications of bicycle wheel and bamboo stick. This may be due to the fact that the soybean in 1991 dry season was faced with inadequate supply of irregated water (Table 4).

V. CONSTRAINTS TO HIGHER PRODUCTION

The farmers' problems faced in soybean cultivation involve in various types of constraints and can be qualified as follows:

(1) Physical constraints are rainfall, soil fertility, irregation and drainage systems. Under these circumstances, the low soil pH associated with the available phosphorus makes great impact to the fertilizer application and yield responses.

(2) Production constraints include :-

(i) The improper practices of soil and water management that cause water logging and prevent seed germination and damage the plantstands.

(ii) Poor water control for each time of irregation causes excess water holding in the field when the land is not practised for any ridging.

(iii) High seed rate use due to farmers' dependency on the local traders with low quality seeds.

(iv) Water availability is unpredictable and limited at the time of needs.

(v) The incedence of pests and diseases causes extra expenses to control.

(vi) In the no-till land preparation, minimal weeding is normally practised affecting to yield reduction and pod shattering.

(3) Socio-economic constraints stem labor shortage at the peak period of planting and harvesting. Low farm gate price was reported to relatively low for two consecutive years due to change in government policy.

VI. CONCLUSION AND RECOMMENDATIONS

A. CONCLUSIONS

Management of land preparation techniques has been carrying on since the second year of the Project. The investigation on the effect of field burning, the introduction of planting tools -inverted- T seeder, hand pull planter and bicycle wheel-, and testing the types of weed control and fertilizers are the goals that would lead to greated cost efficiency and yield sustainability. The outcomes showed satisfactory results for economic returns. The input Package recommendation may include the application of planters, for instance, inverted - T seeder or hand pull planter as a mean to reduce production cost for labor saving and efficient way for seed application with least cost. The fertilizer experiment is the other objective of the Project to find the most economical profit for the use of fertilizer that marketed throughout, It was found that the fertilizer, 16-20-0, at the rate of 7.5 to 30 kg/rai would give the net returns as those who applied 12-24-12 at rated of 25 kg/rai, and of course, with lower production cost.

B. RECOMMENDATIONS

Based on the findings of the study, a few recommendation have been made and deserved attention:

1. CROP MANAGEMENT RESEARCH

To develop the package of technology, research should receive the highest priority to modify the existing farmers' practices on optimum tillage operations for better water management, and recommendations for seed rate, kinds of fertilizer, economic threshold for pest management as site specific. However, the desired project should bear in mind on cost reduction as a short term criteria and improved productivity would be the longer term objective.

2. SOCIO-ECONOMIC RESEARCH.

It consists of two facets to be dealt with. On one hand, the research on production economics and marketing research as well as on procesing distribution and marketing systems should be paid attention as a mean for data information and for the policy makers' decision for demand promotion. On the other hand, the adoption of new technology as mentioned before is required to test for the economic viability at the stages before dissemination to farmers.

VII. REFERENCES

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Table 1 Costs and Returns on On-farm Experiment
of Irrigated Soybean Technology Package
in Sanpatong District, Chiangmai Province
Dry Season 1990

Item	Inverted – T						Conventional Dibbling					
	Burning			No-burning			Burning			No-burning		
	Mulching	Post	Check	Mulching	Post	Check	Mulching	Post	Check	Mulching	Post	Check
1. Cost that vary	950. 76	997.58	829.29	786.77	903.85	685.10	1,075.54	1,150.81	968.44	1,013.15	1,045.85	868.84
mowing	51.00	51.00	51.00	–	–	–	51.00	51.00	51.00	–	–	–
field burning	55.50	55.50	55.50	–	–	–	55.50	55.50	55.50	–	–	–
planting	50.00	50.00	50.00	50.00	50.00	50.00	164.50	164.50	164.50	164.50	164.50	164.50
weed control	–	25.00	–	–	25.00	–	–	25.00	–	–	25.00	–
harvesting	172.50	172.50	166.00	146.00	178.00	151.50	146.00	161.50	146.00	166.00	162.50	151.50
collecting	106.00	106.00	102.00	90.00	109.00	93.00	90.00	99.00	90.00	102.00	99.00	93.00
threshing	153.22	154.16	147.11	140.53	157.92	134.42	139.59	143.35	136.77	149.93	143.82	134.89
seed	195.00	195.00	195.00	195.00	195.00	195.00	261.00	261.00	261.00	261.00	261.00	261.00
herbicide	–	119.00	–	–	119.00	–	–	119.00	–	–	119.00	–
straw	100.00	–	–	100.00	–	–	100.00	–	–	100.00	–	–
opportunity cost	67.54	69.42	62.68	65.24	69.93	61.18	67.95	70.96	63.67	69.72	71.03	63.95
2. Cost that fix	737.82	737.82	737.82	844.32	844.32	844.32	623.32	623.32	623.32	729.82	729.82	729.82
3. Total cost (B/rai)	1,688.58	1,735.40	1.567.11	1,631.09	1,748.17	1,529.42	1,698.86	1,774.13	1,591.76	1,742.97	1,775.67	1,598.66
4. Yield (kg/rai)	326.00	328.00	313.00	299.00	336.00	286.00	297.00	305.00	291.00	316.00	306.00	287.00
5. Return (B/rai)	2,353.72	2,368.16	2,259.86	2,158.78	2,425.92	2,064.92	2,144.34	2,202.10	1,101.02	2,303.18	2,209.32	2,072.14
6. Net return (B/rai)	665.14	632.76	692.75	527.69	677.75	535.50	513.43	427.97	509.26	560.21	433.65	473.48
(%)	39.39	36.46	44.20	32.35	38.77	35.01	30.22	24:12	31.99	32.14	24.42	29.62

Note : (1) Soybean price is 7.22 B/kg
(2) Interest rate is 12.5% for 4 months
(3) Seed rates are 13 kg/rai for Inverted – T planter and 17.4 kg/rai for Conventional Dibbling

Table 2 Costs and Returns on On-farm Demonstration of Irrigated Soybean Technology Package in Sampatong District, Chiangmai Province Dry Season 1990

Item	Inverted – T			Conventional Dibbling		
	Burn	cut	control	Burn	cut	control
1. Cost that vary	792.07	720.51	651.58	967.81	894.20	839.14
mowing	51.00	51.00	–	51.00	51.00	–
field burning	55.50	–	–	55.50	–	–
planting	50.00	50.00	50.00	164.50	164.50	164.50
harvesting	151.50	146.00	140.00	146.00	140.00	140.00
collecting	93.00	90.00	86.00	90.00	86.00	86.00
threshing	134.42	129.72	124.55	131.13	125.96	124.08
Seed	195.00	195.00	195.00	261.00	261.00	261.00
opportunity costs	61.65	58.79	56.03	68.68	65.74	63.54
2. Cost that fix	749.24	749.24	749.24	749.24	749.24	749.24
3. Total costs (B/rai)	1,541.31	1,469.75	1,400.82	1,717.05	1,643.44	1,588.36
4. Yield (kg/rai)	286.00	276.00	265.00	279.00	268.00	264.00
5. Return (B/rai)	2,064.92	1,992.72	1,913.30	2,014.38	1,934.96	1,906.08
6. Net return (B/rai)	523.61	522.97	512.48	297.33	291.52	317.73
(%)	33.97	35.58	36.58	17.32	17.74	20.00

Note : (1) Soybean price is 7.22 B/kg
(2) Interest rate is 12.5% for 4 months
(3) Seed rates are 13 kg/rai for Inverted – T planter and 17.4 kg/rai for Conventional Dibbling

Table 3 Costs and Returns on On-farm Fertilizer Experiment of Irrigated Soybean Technology Package in Sansai District, Chiangmai Province Dry Season 1991

Item	Control	Fertilizer 16-20-0 (kg/rai)					Fertilizer 12-24-12
		(7.5)	(15)	(30)	(60)	(90)	(25)
1. Cost that vary	610.74	736.83	800.58	908.24	1,092.05	1,271.99	948.31
fertilizing	-	30.00	37.20	42.00	60.00	72.00	42.00
harvesting	192.00	210.00	214.80	219.00	219.00	219.00	219.00
collecting	138.00	151.20	154.80	160.80	160.80	160.80	160.80
threshing	209.76	229.71	235.41	243.96	242.82	243.96	244.53
fertilizer	-	39.90	79.80	159.60	319.20	478.80	197.50
opportunity costs	70.98	76.02	78.57	82.88	90.23	97.43	84.48
2. Cost that fix	1,163.78	1,163.78	1,163.78	1,163.78	1,163.78	1,163.78	1,163.78
3. Total costs (B/rai)	1,774.52	1,900.61	1,964.36	2,072.02	2,255.83	2,435.77	2,112.09
4. Yield (kg/rai)	368.00	403.00	413.00	428.00	426.00	428.00	429.00
5. Return (B/rai)	2,719.52	2,978.17	3,052.07	3,162.92	3,148.14	3,162.92	3,170.31
6. Net return (B/rai)	945.00	1,077.56	1,087.71	1,090.90	892.31	727.15	1,058.22
(%)	53.25	56.70	55.37	52.65	39.56	29.85	50.10

Note : (1) Soybean price is 7.39 B/kg
(2) Interest rate is 12.5% for 4 month

Table 4 Costs and Returns on On-farm Demonstration of Irrigated Soybean Technology Package in Sanpatong District, Chiangmai Province Dry Season 1991

Item	Hand pull planter	Bicycle whell	Bamboo stick
1. Cost that vary	603.05	659.32	418.39
planting	30.00	60.00	120.00
harvesting	134.40	125.40	125.40
collecting	82.20	76.80	73.80
threshing	99.17	92.59	89.30
seed	195.00	240.00	240.00
opportunity costs	62.28	64.53	66.89
2. Cost that fix	953.91	953.91	953.91
3. Total costs (B/rai)	1,556.96	1,613.23	1,672.30
4. Yield (kg/rai)	211.00	197.00	190.00
5. Return (B/rai)	1,559.29	1,455.83	1,404.10
6. Net return (B/rai)	2.33	-157.40	-268.20
(%)	0.15	-9.76	-16.04

Note : (1) Soybean price is 7.39 B/kg
(2) Interest rate is 12.5% for 4 months
(3) Seed rates are 13 kg/rai for Hand pull planter and 16 kg/rai for both Bicycle wheel and Bamboo stick