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Soybean in Cropping System in Central Thailand I. The Effect of Different Planting Methods on the Establishment and Yield of Soybean Planted after Rice

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ABSTRACT

The study of different land preparations and planting methods on the growth and yield of soybean after rice was conducted at Kapangsean Campus of Kasetsart University between January – April 1984. The different land preparations were 1) tillage; 2) no-tillage + straw burned; 3) no-tillage + no straw burned, and 4) no-tillage + rice stubble left over; and three planting methods of 1) drill planting, 2) hill planting, and 3) broadcasting were alternatively arranged into eight treatments. Soybean variety S.J. 4 was planted using the seeding rate of 62.5 kg/ha.

The result of the study indicated that no-tillage + straw burned method provided efficient weed control measures as similar to the tillage operation. Without straw burning, weed infestation was high. The yield of soybean in the tillage plots was higher than no-tillage + straw burned treatments, because tillage provided a better root condition for soybean growth. The yield of no-tillage + no straw burned was low due to weed infestation. Seed size of soybean on no-tillage + no straw burned was smaller than those of other treatments due to weed infestation at the later stage of plant development.

INTRODUCTION

The increase in soybean production is very important for Thailand economy. The amount of soybean produced each year satisfy only one-fourth of the total national requirement (Agricultural Statistic Center, 1981). It is obvious that the northern provinces alone can not produce soybean up to the sufficient amount. Then, we should look into the possibility of growing soybean in other areas of Thailand.

The Maeklong basin, in which Kampangsaen campus of Kasetsart University is centrally located, are developing large irrigation scheme in which large area can be fully or partly irrigated in the dry season. Important economic field crops of high potential values are being tested for the suitability of growing after rice in the double cropping scheme. Similarly, the possibility of growing soybean crop in the rainy and dry seasons in any particular cropping system should never be overlooked.

In the northern provinces of Thailand, soybean is planted in the paddy field in the irrigated areas after rice has been harvested in December. The farmers practice different land preparations and planting methods for soybean such as conventional tillage, no-tillage + straw burned and no-tillage + broadcasting as discussed by Pookpakdi (1984). No-tillage + straw burned has been practiced for planting soybean in the north. In this method, rice fields are burned after rice stubble has been cut, and straw was uniformly spread covering the ground. Then soybean seeds are planted directly to the field without tillage operation. No-tillage + straw burned does not only

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shortern the turn-around period between the crops of rice and soybean, but also offers a suitable and cheapest weed control measures. Syariffudin (1980) also found that soil moisture was better conserved in the top soil layer in no-tillage plot, comparing to the plot receiving conventional tillage.

MATERIALS AND METHODS

The experiment, statistically designed as randomized complete block with four replications was conducted in the paddy field of the University Farm, Kasetsart University Kampangsaen Campus in which the soil is heavy clay in nature. In this particular field, local rice variety Nang Mon had been harvested on the 10^{th} of January 1984, soybean was subsequently planted one week after. Total number of individual plots were 32 of 4.5 x8.0 m. The planting treatments used were described as followed:

Treatment 1 : Tillage, ridging up followed by drill plating soybean in rows.
Treatment 2 : Tillage, broadcasting seeds.
Treatment 3 : No-tillage + straw burned, drill planting soybean in row.
Treatment 4 : No-tillage + straw burned, hill planting.
Treatment 5 : No-tillage + straw burned, broadcasting seeds.
Treatment 6 : No-tillage + no straw burned, drill planting soybean in row.
Treatment 7 : No-tillage, no straw burned, hill planting.
Treatment 8 : No-tillage + no stubble cut, hill planting.

In treatment 1 and 2, the plots were tilled by rototiller. In treatment 3, 4 and 5, rice stubble was cut, straws were spread uniformly covering the ground before burning took place. For treatment 6 and 7, rice stubble was cut and removed from the fields, for treatment 8, soybean seeds were planted directly to the field in which rice stubble had been left in the field after rice harvest.

The S.J. 4 soybean variety was used in this experiment. Seeding rate for soybean was 62.5 kg per ha. That particular seed lot gave 90% germination under laboratory condition. In drill planting, seeds were drilled evenly in rows on the ridge, using the row spacing of 50 cm. In the hill planting, distance between hill was 25 x 25 cm, three to five seeds were planted in each hill. The same amount of seeds was broadcasted evenly in the broadcasting treatments.

Weed samples were taken twice at 30 days after planting soybean and at maturity. Samples were collected from 0.5 m^2 quadrat, dried up to a constant weight at 60° C in the oven before weighing took place. Soybean was harvested on April 30, 1984. The yield and yield component data were collected.

RESULTS AND DISCUSSION

1. Weed dry weight

At 30 days after planting, the amount of weed expressed as dry weight per square metre was significantly higher ($P < 0.01$) in the treatment in which stubble was cut, removed but no straw burning (treatments 6, 7) as compared to other treatments (Table I). The amount of weed in the tillage and no-tillage straw burned treatments was not significantly different at 30 days after planting, this indicated that no-tillage + straw burned provided weed control measures comparable to tillage operation. In treatment 8, in which rice stubble was not cut, the amount of weed was also low due to the shading of stubble which inhibited weed growth. Weed dry weight at harvesting of soybean was also high in the treatments in which rice stubble was not cut as compared to other treatments ($P < 0.01$). However, in no-tillage straw burned and tillage plots, the amounts of weeds were not significantly dif-

Table 1. Dry weight of weed (g/m^2) in different soybean plots as affected by land preparation and method of planting treatment.

TREATMENTS	AT 30 DAY[1] AFTER PLANTING	AT SOYBEAN[1] HARVESTING
1. Tillage + drill planting	101.1 b	115.4 b
2. Tillage + broadcasting	138.5 b	87.7 b
3. No-tillage + straw burned + drill planting	88.5 b	140.9 b
4. No-tillage + straw burned + hill planting	89.4 b	107.8 b
5. No-tillage + straw burned + broadcasting	90.9 b	117.8 b
6. No-tillage + no straw burned + drill planting	391.9 a	366.3 a
7. No-tillage + no straw burned + hill planting	395.5 a	347.4 a
8. No-tillage + rice stubble left over	140.9 b	361.8 a

1/ In a column, means followed by a common letter are not significantly different at the 1% level of probability.

ferent. This result also confirmed the effectiveness of weed control in no-tillage + straw burned as comparable to the tillage plot.

2. Yield and yield components of soybean

The yield and yield components of soybean were presented in Table 2. Under Kampangsaen environment, tillage planting soybean gave the highest yield compared to other treatments. The yields of soybean in the tillage plot were higher than that of no-tillage straw burned. This was probably due to the fact that soybean in the tillage plots had better root growth in well aerated soil of tillage plots. Broadcasting seeds of soybean in the tillage plot gave slightly higher yield than that planted in row. From the result of this experiment, tillage operation followed by broadcasting soybean seeds may be suitable for soybean planting after rice in heavy clay soil such as those at Kampangsaen. Among the treatments of no-tillage planting + straw burned plots gave higher yield of soybean than the plots in which straw was not burned. This yield difference between plots receiving straw burning and no burning could be attributable to weed. In the treatments in which stubble was not cut, the yield of soybean was low due to the poor growth they had because of the shading effect of rice stubble imposed.

The yield per plant and pod number per plant of soybean in tillage drill planting is significantly different from other treatments. The fact that yields and number of pods per plant of soybean in all treatments, except treatment 1 (tillage drill planting) were not significantly different from each other, (Table 2), also suggested that the difference in yield per hectare of soybean in most treatments were affected by plant number as well. It is likely that different planting methods used may reduce plant number in some treatments particularly broadcasting and no-tillage planting as compared to tillage plot. The number of pod per plant and yield per plant behaved similarly and also reflected the growth of soybean. In treatment 8, the yield per plant and pod number were lowest. This is probably due to the effect of shadding on soybean, imposed by unremoved rice stubble, particularly at the seedling stage.

Seed size of soybean was significantly lower in the no-tillage, no straw burned plots compared to no-tillage straw burned and tillage plots ($P < 0.05$). The seed size was reduced

Table 2. Yield and yield components of soybean planted in various treatments having different land preparation and method of planting after rice had been harvested.1/

Treatment	Yield (kg/ha)	Yield per plant (g)	No. pod per plant	No. seed per plant	Seed size (g/100 seeds)
1. Tillage + drill planting	2,007.5 a	7.8 a	43.1 a	1.6 a	11.7 a
2. Tillage + broadcasting	2,123.6 a	4.9 b	27.5 b	1.6 a	11.2 a
3. No-tillage + straw burned + drill planting	1,298.4 bc	4.8 b	27.9 b	1.5 a	11.0 a
4. No-tillage + straw burned + hill planting	1,430.6 b	5.1 b	29.5 b	1.5 a	11.3 a
5. No-tillage + straw burned + broadcasting	1,421.6 b	5.1 b	27.8 b	1.7 a	11.2 a
6. No-tillage + no straw burned + drill planting	1,047.4 d	3.9 b	26.0 b	1.5 a	9.8 b
7. No-tillage + no straw burned + hill planting	1,206.4 c	4.1 b	25.7 b	1.6 a	10.0 b
8. No-tillage + rice stubble left over	758.6 e	3.4 b	21.1 b	1.6 a	9.8 b

1/ In a column, means followed by a common letter are not significantly different at 5% level of probability.

significantly in these treatments due to heavy weed infestation particularly at the period after flowering. In Table 1, the dry weight of weed sampled at soybean harvesting in no-tillage, no straw burned plots (treatments 6, 7 and 8) were much higher than other treatments. Seed size of soybean could be reduced tremendously due to weed competition.

CONCLUSION

The result of this study indicated that, in the paddy field of the Maeklong basin such as Kampangsaen, soybean can be grown after rice. Due to heavy clay texture of soil in nature, tillage planting soybean after rice should be done. Broadcasting soybean seeds after land preparation may give similar result in soybean establishment and yield as compared to row planting. Method of broadcasting seed after tillage operation should be investigated further for the economic suitability. Meanwhile, no-tillage burning straw may offer an alternative method for establishment of soybean after harvesting rice, if farmers lack mechanical implements for land preparation. Unlike in the northern provinces, although no-tillage straw burned method provides successful weed control measure as comparable to tillage operation, it does not provided suitable condition for root growth for the type of heavy clay soil.

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