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DAFTAR ISI

	Halaman
Farming system research on Madura Tobacco SOENARDI, MUCHAMAD YUSRON, A.S. MURDIYATI and MUKANI	99
A study of optimum cropping pattern and irrigation system on cotton + soybean cropping at lowland of rainfed area, South Sulawesi J. LIMBONGAN, J. WIROATMODJO, I. GONARSYAH, HASNAM D, MURDIYARSO, and H.M.H. BINTORO DJOEFRIE	109
Cotton and sesame intercropping on dry land SYAFRUDIN KADIR and PETER TANDISAU	120
Isolation of <i>Pseudomonas syzygii</i> bacterium from <i>Batracomorphus cocles</i> a potential insect vector of xylem limited bacterium in clove ADRIA and HERWITA IDRIS	129
The effect of the ash from oilpalm fruit bunch and micro foliar fertilizer on the growth of vanilla stem cutting ROSIHAN ROSMAN, SUDIRMAN YAHYA and M. IDRUS MARPAUNG	136
Development of cotton pest <i>Helicoverpa armigera</i> Hubner on several alternate hosts ELNA KARMAWATI and AGUS KARDINAN	145
Patchouli oil products as insects repellent TRI L. MARDININGSIH, TRIANTORO, S.L. TOBING and S. RUSLI	152



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FARMING SYSTEM RESEARCH ON MADURA TOBACCO

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ABSTRACT

Farming system research on Madura tobacco was carried out for three years, from 1990/1991 to 1992/1993 in three villages, i.e. Sera Barat, Kambangan Barat and Talang. In 1992/1993 the improved technologies introduced were tobacco cultivation and cropping pattern. The aim of the research was to improve farmers' technology practices and cropping patterns. The results of the research showed that most of technologies introduced could be adopted by the farmers, the best cropping pattern in Sera Barat was corn/ stringbean-tobacco; in Kambangan Barat was maize-onion-rice-tobacco; while in Talang was maize-rice-tobacco. By applying improved tobacco technology, farmer's income increased by Rp 655,000, Rp 415,060 and Rp 892,521 per hectare annually in the respective villages, whereas the improvement of technology and cropping pattern increased farmer's income by Rp 714,295, Rp 1,521,514 and Rp 892,521 respectively.

Key words : Technology transfer, farming system, *Nicotiana tabacum*, cropping pattern

RINGKASAN

Penelitian sistem usahatani tembakau Madura

Penelitian sistem usahatani tembakau Madura telah dilaksanakan selama tiga tahun (1990/91 - 1992/93) di tiga desa, yakni Desa Sera Barat, Kambangan Barat dan Talang, yang kesemuanya berada di wilayah Kabupaten Sumenep. Pada tahun ketiga (1992/1993), rakitan teknologi yang diintroduksi meliputi teknologi budidaya tembakau dan pola tanam. Selain untuk memperbaiki teknologi budidaya, penelitian ini juga diarahkan untuk memperoleh pola tanam yang sesuai untuk masing-masing lokasi. Hasil penelitian menunjukkan bahwa tingkat adopsi teknologi budidaya tembakau oleh petani cukup tinggi. Pola tanam terbaik untuk Desa Sera Barat adalah jagung ditumpanggilir dengan kacang tunggak, kemudian tembakau (jagung/kacang tunggak-tembakau); untuk Desa Kambangan Barat adalah jagung-bawang merah-padi-tembakau; dan untuk Desa Talang adalah jagung-padi-tembakau. Perbaikan teknologi tembakau menambah pendapatan petani di Desa Sera Barat, Kambangan Barat dan Talang berturut-turut sebesar Rp 655 000, Rp. 415 060 dan Rp 892 521/ha/th. Sedang dengan perbaikan teknologi dan pola tanam meningkatkan pendapatan petani masing-masing sebesar Rp 714 295, Rp 1 521 514 dan Rp 892 521/ha/th.

Kata kunci : Alih teknologi, usahatani, tembakau Madura, pola tanam

INTRODUCTION

Until now, there is still a gap between the technology produced by research institute and the technology used by the farmers. One of the methods which is expected to lessen the technological gap is farming system research (FSR). Farming system research is an activity to accelerate the technology transfer which considers the condition of environment and farmers as a whole system (SHANER *et al.*, 1982). In this approach, the technological package to be recommended is corrected and matched with the environment of the local condition. Therefore, FSR is a practical research, in that to find out farmers' need, their experience and knowledge should be considered.

One of the commodities which faces the problem of technological gap is tobacco. Tobacco, as raw material for cigarettes has been cultivated in Madura for more than three decades, particularly in Sumenep and Pamekasan districts, however, the productivity of the crop at farmer level is low, i.e., less than 400 kg sliced tobacco per ha (ANON., 1988).

The components of the technology resulted by the Research Institute for Tobacco and Fibre Crops from 1988 to 1990 showed that the potency of Madura tobacco yield is more than 800 kg/ha. This farming system research was conducted to accelerate the transfer of Madura tobacco cultivation technology. It was conducted together with related institutions and farmers.

The improvement of technology, through FSR year I (1990/1991) and year II (1991/1992), namely through the improvement of seed quality, nursery, pruning, and utilization of a sucker control could increase the income of cooperative farmer 43 % and 29 % respectively (SOENARDI *et al.*, 1991 and 1993). The increase in income happe-

ned because the nursery was conducted by the farmer himself; dosage of ammonium sulphate fertilizer was reduced from 300 kg to 200 kg/ha; the cattle manure was not burnt and the plant watering decreased by 10 %.

Previous research also found out that the quality of Madura tobacco was strongly influenced by the planting time, and location. Good quality tobacco was obtained from tobacco planted in the middle of May up to the middle of June. The tobacco planted after that period had low quality, so that the price decreased; between 20-60 %. The delay in planting was frequently a result from the cropping pattern, besides the availability of water and investment. In order that the tobacco can be planted on time a suitable cropping pattern is needed, so that it can provide higher income. The tobacco planted on rice field generally has lower quality, therefore, it is necessary to find the alternative crops which have an economic value as high as tobacco.

The objective of the research was to define a specific location cropping pattern and to find alternative crops to replace tobacco on rice field to increase the farmer's income.

RESEARCH METHODOLOGY

Research in the planting time of 1992/1993 was the third year of the research series which were conducted successively from 1990/1991 to 1992/1993. The research activities in the first year (1990/1991) produced a package of tobacco cultivation technology. In the second year, the research activities produced an alternative cropping pattern by introducing new crops, and the objective of the research in the third year was to test and to define introduction of cropping patterns, technology adoption levels, and to find alternative crops to replace tobacco in the rice field.

The research was conducted in three locations : (1) Sera Barat Village, Bluto Subdistrict,

representing highland area, (2) Kambangan Barat Village, Lenteng Subdistrict, representing dryland area, and (3) Talang Village, Saronggi Subdistrict, representing rice land area. In the highland area, the cropping pattern of non cooperative farmers was maize-rice-tobacco; in the dry land area maize-rice-tobacco; and in rice land area maize-rice-tobacco.

In each village the research was conducted on an area of 2 ha involving 10-15 farmers. Cooperative farmers were the farmers who were guided to implement the assembled technological package based on an agreement between the research technology and farmers' technology. As comparison (control) in this research was the surrounding farmers who used their own technology (Appendix 1).

Beside the package of assembled tobacco cultivation technology, an improved cropping pattern was introduced in the second year in highland area (Sera Barat Village) and dry land area (Kambangan Barat Village) (Appendix 2), while in rice land area (Talang Village) the cropping pattern test was not conducted, because the cropping pattern of the farmer in highland area was maize-maize-tobacco. In this area, mungbean variety Betet and stringbean line KT4 were introduced to the cooperative farmers. Their cropping pattern was changed into (1) maize/mungbean-tobacco, (2) maize/stringbean-tobacco. In the dryland area, the cropping pattern of non-cooperative farmers was maize-rice-tobacco. On the cooperative farmers two cropping patterns were tested : (1) maize relayed cropping with mungbean-rice-tobacco, and (2) maize-onion-rice-tobacco.

In the rice land area (Talang Village), onion cultivation was tested on the other plots as an effort to find alternative crops to replace tobacco on rice land.

The observations were conducted on : (1) income of farming system, (2) income of non-tobacco farming, (3) income of tobacco farming, and (4) level of technology adoption. Data were collected from the field and interviews with the farmers.

RESULTS AND DISCUSSION

Farming system

The land cultivation in Sera Barat, Kambingan Barat, and Talang villages were different based on the land type and water availability. On the rice and dry land where they counted on rainfall, the farmers used their land for a maximum of three croppings per year. While on dry land which received additional water from deep wells, their land could be used up to four croppings.

Further details of the farming system, particularly non-tobacco farmings in Sera Barat, Kambingan Barat, and Talang villages were discussed in the following paragraphs.

Sera Barat village

Cultivated crops

There was a change in the cropping pattern of cooperative farmers in this area, i.e. the second maize was replaced with mungbean or stringbean. It was intended to spare the time for soil preparation for tobacco, because the age of mungbean and stringbean was shorter than maize.

The cropping pattern of maize/stringbean gave the highest income (Table 1). This was related to the decrease in mungbean production and quality due to the rain before harvest, so that the yield was low and damaged. The three cropping patterns did not affect the tobacco growth, al-

though under maize-maize cropping there was no soil preparation. In the highland area, tobacco was planted generally under insertion cropping system 10 days before the maize harvest, so that the soil preparation could only be conducted after the maize harvest. The population per ha ranged between 25,000 and 30,000 plants. Madura tobacco farming used plenty of cattle power, family labours and sharing labours neighbouring farmers. However, at the peak of the activities they still used off-farm paid labour. In Sera Barat village where tobacco area was 200 ha, on an average farmer needed 15 additional labours.

Crop varieties

In the meantime the farmers used the varieties which had been cultivated for years both for tobacco and secondary crops farming, so that the varieties were called local varieties. Tobacco variety used was Jupon Kenek, while the maize variety was Genjah Kertas. For mungbean and stringbean varieties, the farmers were more familiar with local varieties. The introduction of mungbean variety Betet and stringbean line KT4 seemed to be accepted by farmers.

Farm income

From the three cropping patterns applied by the farmers in Sera Barat village, which were (i) maize-maize-tobacco, (ii) maize/mungbean-to-

Table 1. Income of non tobacco farming system in Sera Barat (in rupiah/ha)

Tabel 1. Pendapatan usahatani komoditas di luar tembakau di Sera Barat

Cropping pattern <i>Pola tanam</i>	Cost Biaya		Revenue Penerimaan	Income Pendapatan
	Input Bahan	Labour Upah		
Existing cropping pattern				
<i>Pola tanam lokal</i>				
1. Maize-maize Jagung-jagung	148,993	263,680	786,879	374,206
Introduced cropping pattern				
<i>Pola tanam introduksi</i>				
2. Maize/mungbean Jagung/k. hijau	118,998	263,005	704,581	322,528
3. Maize/stringbean Jagung/k. tunggak	124,335	209,745	767,581	433,501

Note : Crop varieties : Maize = Genjah kertas (local), Mungbean = Betet, stringbean = KT4.

Keterangan : Varietas jagung = Genjah kertas (lokal), Kacang hijau = Betet, Kacang tunggak = KTA

Table 2. Cropping pattern and income of farming system in Sera Barat
Tabel 2. Pola tanam dan pendapatan sistem usahatani di Sera Barat

Cropping pattern <i>Pola tanam</i>	Cost <i>Biaya</i>	Revenue <i>Penerimaan</i>	Income <i>Pendapatan</i>
		Rp	
Existing cropping pattern			
<i>Pola tanam lokal</i>			
1. Maize-maize-tobacco <i>Jagung-jagung-tembakau</i>	1,928,533	2,491,139	562,606
Introduced cropping pattern			
<i>Pola tanam introduksi</i>			
2. Maize/mungbean-tobacco <i>Jagung/k. hijau-tembakau</i>	2,261,053	3,246,981	1,165,928
3. Maize/stringbean-tobacco <i>Jagung/K. tunggak-tembakau</i>	2,213,080	3,489,981	1,276,901

bacco, and (iii) maize/stringbean-tobacco, the cropping pattern of maize/stringbean-tobacco gave the highest income, i.e. Rp 1,276,901/ha/year (Table 2). The income of the farming system, particularly tobacco farming in Sera Barat village in 1992/1993 is presented in Table 7.

Kambingan Barat vilagge

Cultivated crops

The agriculture land of this area was dry land and rainfed rice land. The cultivated crops were tobacco, rice, maize, mungbean, and soybean. Later on onion was introduced.

Crop varieties

The varieties used for each crops were Japon Kenek for tobacco, Genjah Kertas for maize, local and Betet for mungbean, local and Wilis for soybean, and Way Seputih for rice. While the onion which was introduced was a Filipina variety.

Farm income

The cropping patterns applied in Kambingan Barat vilage were : (i) maize-rice-tobacco, (ii) maize/mungbean-rice-tobacco, and (iii) maize-onion-rice-tobacco. The income of non-tobacco farming under each cropping pattern is presented

Table 3. Income of non tobacco farming system in Kambingan Barat
Tabel 3. Pendapatan usahatani komoditas di luar tembakau di Kambingan Barat

Cropping pattern <i>Pola tanam</i>	Cost <i>Biaya</i>		Revenue <i>Penerimaan</i>	Income <i>Pendapatan</i>
	Input Bahan	Labour <i>Upah</i>		
Rp				
Existing cropping pattern				
<i>Pola tanam lokal</i>				
1. Maize-rice <i>Jagung-padi</i>	296,462	336,393	1,789,720	1,126,865
Introduced cropping pattern				
<i>Pola tanam introduksi</i>				
2. Maize/mungbean-rice <i>Jagung/K. hijau-padi</i>	346,150	444,337	2,194,376	1,403,889
3. Maize-onion <i>Jagung-bawang merah</i>	2,005,381	1,098,800	5,337,500	2,233,319

Table 4. Cropping pattern and income of farming system in Kambangan Barat
 Tabel 4. Pola tanam dan pendapatan sistem usahatani di Kambangan Barat

Cropping pattern <i>Pola tanam</i>	Cost <i>Biaya</i>	Revenue <i>Penerimaan</i>	Income <i>Pendapatan</i>
----- Rp -----			
Existing cropping pattern			
<i>Pola tanam lokal</i>			
1. Maize-rice-tobacco <i>Jagung-padi-tembakau</i>	2,541,135	4,605,900	2,064,765
Introduced cropping pattern			
<i>Pola tanam introduksi</i>			
2. Maize/mungbean-rice-tobacco <i>Jagung/K. hijau-padi-tembakau</i>	3,327,677	6,084,526	2,756,849
3. Maize-onion-rice-tobacco <i>Jagung-bawang merah-padi-tembakau</i>	5,641,371	9,227,650	3,586,279

in Table 3. Out of three cropping patterns, the highest income was obtained from the cropping pattern of maize-onion-rice which was Rp 2,233,319 followed by maize/mungbean-rice, and maize-rice. Therefore, the addition of one commodity between maize and rice, i.e. mungbean or onion, was very profitable for the farmers, they respectively gave an additional income of Rp 277,024 and Rp 1,106,454/ha/year.

Through deep well irrigation the farmers could use their land for four croppings per year. Out of three cropping patterns, the highest income was obtained from the cropping pattern of maize-onion-rice-tobacco which was Rp 3,856,260/year

Table 5. Income of farming system in Talang (in rupiah/ha)
 Tabel 5. Pendapatan usahatani di Desa Talang

Cropping pattern <i>Pola tanam</i>	Cost <i>Biaya</i>	Revenue <i>Penerimaan</i>	Income <i>Pendapatan</i>
Maize-rice <i>Jagung-padi</i>	649,132	1,917,400	1,268,250
Non-cooperative farmer			
<i>Petani non kooperator</i>			
Maize-rice-tobacco <i>Jagung-padi-tembakau</i>	3,081,130	6,253,750	3,172,620
Cooperative farmer			
<i>Petani kooperator</i>			
Maize-rice-tobacco <i>Jagung-padi-tembakau</i>	2,932,019	6,997,160	4,065,141

(Table 4). While the income of tobacco farming in Kambangan Barat village was Rp 1,352,960/ha, as it is presented in Table 7.

Talang Village

Cultivated crops

Most of Talang village land was rainfed rice land. The major cultivated crops were tobacco, rice, and maize.

The land cultivation was conducted right after the rainy season came. Secondary crops and rice were planted in the beginning of the rainy season, i.e. around November. The tobacco plant-

ing time was April to October. Dryland tobacco was planted between April and May, while rice land tobacco was planted in June.

Secondary crops were planted solely for staple food, so that its cultivation was not as intensive as that of tobacco cultivation. During tobacco planting time, Talang village needed around 50 additional off-farm labourers (the tobacco area was 370 ha). The farm activities which were considered hard work for the farmers were watering, side-shoots pruning and slicing. Sucker control with Tamex was preferred by the farmers, it reduced the work, and made the tobacco leaves better and thicker so that the production increased.

Crop varieties

Generally, the varieties used both in tobacco and palawija farmings were local varieties. The tobacco variety for dryland was Japon Kenek and for rice field was Japon Raja.

Farm income

The cropping pattern on rice field in the central producing area in Talang village was maize-rice-tobacco. Through this cropping pattern in the planting time of 1992/1993, the income from non tobacco and with tobacco farmings were respectively Rp 1,268,250 and Rp 4,065,141 (Table 5). In relation to the program of tobacco area limitation, where rice field tobacco in Talang village will be abolished, onion farming on rice land, that was not suitable for tobacco, was introduced. This experiment was conducted in four field plots, with a size respectively of 0.1, 0.03, 0.027, and 0.13 ha. Based on this experiment, the average production cost per ha was Rp 2,284,300, consisted production inputs (seeds, fertilizers, insecticides) Rp 1,559,850 and labourers Rp 724,450. The average yield of onion was 5,555 kg dry onion, at a price of Rp 900/kg, the revenue was Rp 4,999,500, so that the income reached Rp 2,715,200/ha within months.

Table 6. Farmer's adoption on improved technologies through farming system research
Tabel 6. Tingkat adopsi petani terhadap teknologi rakitan PSU

Component <i>Komponen</i>	Sera Barat ^{*)}			Kambangan Barat ^{**)}			Talang ^{*)}		
	Yes <i>Ya</i>	No <i>Tidak</i>	Others <i>Lain</i>	Yes <i>Ya</i>	No <i>Tidak</i>	Others <i>Lain</i>	Yes <i>Ya</i>	No <i>Tidak</i>	Others <i>Lain</i>
Variety <i>Varietas</i>	10	-	-	15	-	-	10	-	-
Nursery <i>Pesemaian</i>	10	-	-	15	-	-	10	-	-
Soil cultivation <i>Pengolahan tanah</i>	9	1	-	15	-	-	-	10	-
Fertilizer <i>Pupuk</i>									
- Recommended doses and kind of fertilizer <i>Dosis dan macam pupuk sesuai anjuran</i>	10	-	-	12	-	3	3	7	-
- Burn stable manure before application <i>Cara pemberian pupuk kandang di bakar</i>	4	-	6	8	-	7	8	-	2
- Reduced irrigation <i>Pengairan berkurang</i>	-	10	-	12	3	-	9	-	-
- Desuckering with Tamex <i>Pangkas sirung dengan Tamex</i>	10	-	-	13	-	2	8	-	2
- Leaves harvested twice <i>Pemetikan dilakukan dua kali</i>	7	3	-	15	-	-	-	10	-

Note : ^{*)} from 10 farmers ^{**)} from 15 farmers
Keterangan : ^{*)} jumlah petani peserta 10 orang ^{**)} jumlah petani peserta 15 orang

Table 7. Yield and income of Madura tobacco farming system in 1993, and net income in 1992 and 1991
 Tabel 7. Produksi dan pendapatan usahatani tembakau Madura tahun 1993, dan pendapatan bersih tahun 1992 dan 1991

Location, Group of farming Lokasi, Kelompok petani	Yield Hasil (kg/ha)	Cost Biaya		Revenue Penerimaan	Income ^{*)} Pendapatan		
		Input Bahan	Labour Upah		1993	1992	1991
(Rp/ha)							
Sera Barat							
Cooperative Kooperator	760	175,000	1,704,000	2,722,400	843,400	-200,000	1,184,000
Non-Cooperative Non kooperator	490	152,500	1,363,360	1,704,260	188,400	-260,000	1,001,000
Kambangan Barat							
Cooperative Kooperator	965	466,585	2,070,605	3,890,150	1,352,960	300,000	632,000
Non-Cooperative Non Kooperator	770	410,000	1,468,280	2,816,180	937,900	190,000	374,000
Talang							
Cooperative Kooperator	1,210	277,230	2,005,647	5,079,760	2,796,883	-750,000	1,139,000
Non-Cooperative Non Kooperator	1,100	382,750	2,049,238	4,336,350	1,904,362	-850,000	649,000

*Note : mark (-) means that the farming system loose

Keterangan : tanda (-) berarti usahatani tersebut mengalami kerugian

The net income derived from onion farming was high, but there were some constraints in its development, particularly the expensive investment for seedling, (Rp 1,200,000/ha).

Tobacco farming

The tobacco planting time in Sera Barat, Kambangan Barat, and Talang villages were scheduled between the middle of May and the middle of June, however, actually the planting time was up to the beginning of July 1993. The advancement of the planting time was meant that the tobacco was easy to sell with high price. The highest tobacco price generally happened in August to September, so that the farmers tried to sell their tobacco at that period.

Almost all of the technological packages could be applied by the farmers, except the application of cattle manure and the implementation of 2-time harvest. This condition indicated that the tobacco farmers were responsive to the new technology. Suitable technology would be applied immediately. Table 6 shows the response of the cooperative farmers to PSU technology package.

The technology that was not influenced by local condition and more profitable to farmers was more easily adopted, such as the use of a new variety.

The technology that had not been adopted was the method for cattle manure application. More than 75 % of the farmers applied burnt cattle manure. This related to the condition of the cattle manure used by the farmers. Generally the cattle manure was new drops, so that it should be burnt before it was applied. Some of the farmers applied the fertilizer more than the recommended dosage. Three farmers in Kambangan Barat village added N fertilizer dosage on the plants which looked deficient in N. While seven farmers in Talang village added N dosage about 50 kg/ha using urea fertilizer. Recommendation on perfect soil preparation before planting was not accepted by the farmers in Talang village, because the land was inundated with water. In general, the farmers prepared the soil gradually.

The farmers in Kambangan Barat and Talang villages harvested tobacco leaves all at once. By using this practice, the farmers expected that the selling price of the tobacco leaves was high,

because it was conducted before the middle of September. According to JOKO-HARTONO *et al.*, (1993) on Madura tobacco the one-time harvest of 8-12 leaves at the time when the lower leaves were ripe produced a yield and quality which were not different from those of gradual harvest. The highest yield and quality of rice field tobacco were obtained when the harvest of the 12 leaves was conducted at one time (JOKO-HARTONO *et al.*, 1989), while on dryland tobacco the highest yield and quality were obtained when the harvest was conducted at once for 8-12 leaves. In Sera Barat village tobacco was harvested twice because the planting was earlier than in the other two villages. The production and the income of cooperative farmers and non-cooperative farmers are presented in Table 7.

Table 7 shows that the productivity of cooperative farmers was higher than that of non-cooperative farmers, therefore their income was also higher.

The Table 7 also indicates that the income of tobacco farming in Talang village fluctuated, but its average income was higher than those of the two other villages.

The average income of the tobacco farmings in Talang, Kambangan Barat, and Sera Barat villages respectively were Rp 814,874; Rp 631,143 and Rp 459,467/planting season. The production and the income of tobacco farming in Kambangan Barat village were more stable because the water availability was more secured.

CONCLUSION

The level of tobacco cultivation technology adoption in Madura was high. The best cropping patterns that can be recommended for each location are : (a) Sera Barat village: maize/stringbean-tobacco, (b) Kambangan Barat village : maize-onion-rice-tobacco, and (c) Talang village; maize-rice-tobacco.

The improvement of tobacco cultivation technology increased the farmer's income in Sera

Barat, Kambangan Barat and Talang villages, in 1993 respectively Rp 655,000; Rp 415,060; and Rp 892,521. The average additional incomes in three years were Rp 299,333; Rp 261,020, and Rp 94,174. While the improvement of tobacco technology and cropping pattern increased the farmer's income respectively Rp 714,295; Rp 1,521,514, and Rp 982,521.

Onion is one the alternative crops that can replace tobacco, however it still needs assistance in the supply of seedlings.

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Appendix 1. Technology package of tobacco cultivation of cooperative and non-cooperative farmers
 Lampiran 1. Paket teknologi budidaya tembakau pada petani kooperator dan non kooperator

Component <i>Komponen</i>	Technological package of tobacco cultivation <i>Paket teknologi budidaya tembakau</i>	
	Cooperative farmer <i>Petani kooperator</i>	Non-cooperative farmer <i>Petani Non kooperator</i>
Variety <i>Varietas</i>	Jepun kenek Prancak Produced the seedlings	Jepun kenek prancak Generally bought the seedlings
Nursery soil cultivation <i>Pesemaian</i>	For high land and dryland the soil was prepared before planting.	Not always, depended on the time of the crop harvest, it was conducted when there was time for that.
Fertilizer :		
High land and dry land <i>Gunung dan tegal</i>	200 kg AS+100 kg TSP+2000 kg cattle manure per ha. Cattle manure was not burnt.	300 kg AS+100 kg TSP+2000 kg cattle manure per ha. Cattle manure was burnt.
Rice land <i>Sawah</i>	300 kg AS+100 kg TSP+2000 kg cattle manure per ha. Cattle manure was not burnt.	200kg Urea+100kg ZA+100kg TSP +2000kg cattle manure per ha. Cattle manure was burnt.
Watering <i>Pengairan</i>	1-30 DAP everyday 31-45 DAP every 2 days 46-60 DAP every 5 days	1-30 DAP everyday 31-45 DAP every 2 days 46-60 DAP every 5 days
Pruning <i>Pangkas</i>	Pruned the tip of the plant, 3 leaves by hand. Desuckering with Tamex.	Pruned the tip of the plant, 3 leaves by hand. Desuckering controlled by hand.
Harvest <i>Pemetikan</i>	Conducted 2 times, each 50% not included <i>krosok</i> .	Not constant, depended on plant condition and market situation.

one row cotton was higher in shedding because it did not supported with good irrigation system. The highest yield (1,83 kg/ha cotton seed + 715 kg soybean/ha) was produced in three rows of cotton and seven rows of soybean that was irrigated at 0-60 days after planting at 50 % field capacity and at 61-120 days after planting to make 100 % field capacity. The profit of the farmers could be increased up to Rp. 825 333/year under optimum condition.

Key words : Cropping pattern, irrigation system, *Gossypium hirsutum*, *Glycine soja*

RINGKASAN

Kajian pola beranam dan sistem pengairan yang optimal bagi usahatani kapas + kedelai di lahan sawah tanah hujan, Sulawesi Selatan

Penelitian dilaksanakan di kabupaten Takalar, Sulawesi dari bulan Februari sampai Maret 1992 dan bulan April sampai September 1994. Penelitian pertama dilakukan dengan metode survei yang di analisis dengan program linear. Penelitian kedua dirancang berbasis hasil sistem penelitian

permana dan beranam. Hasil penelitian menunjukkan bahwa pola beranam yang optimal adalah pola beranam tiga baris kapas dan tujuh baris kedelai yang disertai dengan sistem pengairan secara dangkal 50% kapasitas lapangan pada umur 0-60 hari disusul dengan 100% kapasitas lapangan pada umur 61-120 hari. Keuntungan optimum pola beranam Rp. 825.333/tahun.

Key words : Pola tanam, sistem pengairan, *Gossypium hirsutum*, *Glycine soja*

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is the main raw material for textile industry and textile products. According to WORSHAM (1989), 90% of world requirement is obtained from cotton fiber and the rest (10%) from synthetic fibers. In Indonesia cotton demand increases every year proportionally to the demand of textile and textile products.

Appendix 2. Cropping pattern of cooperative and non-cooperative farmers in each site location
 Lampiran 2. Pola petani kooperatif pada masing-masing lokasi penelitian

Location/Village Lokasi/Desa	Land type Tipe lahan	Cooperative farmer Petani kooperatif	Non-cooperative farmer Petani non kooperatif
Sera Barat	High land Tegal gunung	1. Maize/mungbean-tobacco 2. Maize/stringbean-tobacco	Maize-maize-tobacco
Kambangan Barat	Dryland Tegal	1. Maize/mungbean-rice-tobacco 2. Maize-onion-rice-tobacco	Maize-rice-tobacco
Talang	Rice land Sawah	Maize-rice-tobacco	Maize-rice-tobacco

The average income of tobacco farming in Talang, Kambangan Barat and Sera Barat villages respectively were Rp 814,874; Rp 631,143 and Rp 459,467/planting season. The production and the income of tobacco farming in Kambangan Barat village were more stable because the water availability was more secured.

CONCLUSION

The level of tobacco cultivation technology was high. The best cropping pattern was recommended for each location. The cropping pattern maize/stringbean-tobacco in Sera Barat village, maize-maize-tobacco in Talang village and maize-rice-tobacco in Kambangan Barat village were more stable because the water availability was more secured.

High land and dry land tobacco farming in Talang village, Kambangan Barat and Sera Barat villages. The average income of tobacco farming in Talang, Kambangan Barat and Sera Barat villages respectively were Rp 814,874; Rp 631,143 and Rp 459,467/planting season. The production and the income of tobacco farming in Kambangan Barat village were more stable because the water availability was more secured.

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