Weeds Growth in Various Population of Corn-Peanut Intercropping

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ABSTRACT

The existence of weeds on sweet corn crops can lead to competition that reduce the yield. The aim of this research was to obtain the optimum crop proportion of corn-peanut plants in suppressing weed growth but not decrease the yield of sweet corn. The experiment was conducted using a single factor field experimental method arranged in a complete randomized block design with 3 blocks as replication. The treatment was the proportion of sweet corn-peanut population consisting of 3 levels, i.e 1:1, 1:2, 1:3, sweet corn monoculture and peanut monoculture as comparison.The results of this research showed that intercropping of sweet corn+peanut with population proportion of 1:2 can suppress weed growth in on the 9th week (at harvest) without decreasing sweet corn yield.

Keywords: Sweet corn, Weeds, Intercropping, Peanut

ABSTRAK

Keberadaan gulma pada tanaman jagung manis dapat menyebabkan persaingan yang mengurangi hasil panen. Tujuan penelitian ini adalah untuk mendapatkan proporsi tanaman jagung-kacang tanah yang optimal dalam menekan pertumbuhan gulma tetapi tidak menurunkan hasil jagung manis. Percobaan dilakukan menggunakan metode eksperimental lapangan faktor tunggal yang disusun dalam rancangan acak lengkap dengan 3 blok sebagai replikasi. Perlakuan adalah proporsi populasi jagung manis kacang tanah yang terdiri dari 3 taraf, yaitu 1: 1, 1: 2, 1: 3, jagung manis monokultur dan monokultur kacang tanah sebagai pembanding. Hasil penelitian ini menunjukkan bahwa tumpangsari jagung manis-kacang dengan proporsi populasi 1 : 2 dapat menekan pertumbuhan gulma pada minggu ke 9 (saat panen) tanpa menurunkan hasil jagung manis.

Kata Kunci: Jagung manis, Gulma, Tumpangsari, Kacang tanah

INTRODUCTION

Geographically, Indonesia is located in the tropics in which almost all of plants grow well including sweet corn. This means that the business opportunity for the develompent of sweet corn in Indonesia has a good prospect. One of the efforts to increase sweet corn production is through intensification with appropriate cropping system.

Sweet corns are commonly planted in monoculture farming with wide-spaced rows that triggers the lush growth of weeds at surroundings. The existence of weeds in sweet corn leads to a competition between sweet corns and weeds in absorbing sunlight, nutrient, water, growing spaces, and carbon dioxide. Hendrival et al. (2014) argued that such competition will decrease crops yields quantity and quality. Some weed species produce allelopathic harmful compounds that can kill plants (Sembodo, 2010). For this reason, weeds should be controlled. Generally, farmers apply herbicides for weed control.

The use of herbicide for weeds control potentially damages environment. That is why the use of it should be limited. In order to decline the negative effects of herbicide, weeds control can be done through culture techniques, in which sweet corn is intercropped with peanuts. Peanut plants belong to leguminoseae. They have different morphological forms compared to sweet corn (graminae), which are able to adapt to the environment widely and more resistant to pests. They relatively have the

same growing requirements as sweet corn. Thus, they could be mutual symbiotic.

Setiawan (2005) said that the presence of peanuts intercropped with sweet corn can reduce the light intensity on land surface, but it did not affect the moisture content. Low intensity transmitted on the land surface could suppress the wide growth. Widyaningrum (2004) reported that growth and yield of sweet corn were not decreased when intercropped with peanut. The plant spacing must be arranged to sufficient needs of main crops and intercrops, so that the growth is not inhibited. The result of research by Septiana (2012) showed that intercropping between sweet corn and soybean resulted in the highest yield of corns is of 2.34 ton/ha and soybeans of 1.06 ton/ha with 75 cm x 25 cm plant spacing.

The aim of this research was to obtain the optimum crop proportion of corn+peanut plants in suppressing weed growth without decreasing the yield of sweet corn.

MATERIALS AND METHODS

The research was conducted at land of Faculty of Agriculture, of Universitas Muhammadiyah Yogyakarta from December 2016 to April 2017.

The materials used were seeds of sweet corns cv. 'Sweet Boy', peanuts cv. 'Kancil', manure, urea SP-36, and KCl. Tools used were agricultural equipment, leaf area meter, analytic scale, and oven.

A single factor field experiment was arranged in completely randomized block design with 3 blocks as replication. The treatments were:

JM : Monoculture of sweet corn
KT : Monoculture of peanut
TS 1 : Intercropping of sweet corn + peanut with proportion of 1:1
TS 2 : Intercropping of sweet corn + peanut with proportion of 1:2
TS 3 : Intercropping of sweet corn + peanut with proportion of 1:3

The observation on weeds was done at the age of 3, 7, and 9 weeks after planting with vegetation analysis. Vegetation analysis was performed through quadratic method with three samples of field with the size of 0.5 m x 0.5 m each. The observed variables in vegetation analysis of weeds include density, frequency, dominance, SDR, and weeds community coefficients. In addition, this research also covered the observation of yield components, yields, and LER.

The data were analyzed using analysis of variance (ANOVA) at α 5%. The data of significantly different treatments were further tested by Duncan's new multiple range test.

RESULTS AND DISCUSSIONS

Weeds Dominance

The results of weeds vegetation analysis 3 weeks after planting showed that there were 20 types of weeds which grow in sweet corn area. The summed dominan ratio (SDR) value of weeds on three weeks after planting are presented in Table 1. Based on the mean score, SDR value indicated the type of dominant weed was *Cyperus rotundus* (51,31%), other weeds were relative dominant. There were *Alternanthera sessilis, Ageratum conyzoides* and *Cleome rutidosperma* with SDR mean score of 8,83%, 6,79% and 5,74% respectively.

*Cyperus rotundus*is is a type of weeds living on the land that reproduces by seed and rhizome. Rhizomes are sequences form like a chain. Mangoensoekarjo and Soejono (2015), said that only the rhizome's shoots near the surface land could grow and others stayed dormant. Meanwhile, *Alternanthera sessilis, Ageratum conyzoides,* and *Cleome rutidosperma* are type of wide leave weeds that reproduces by seeds as well, and *Alternanthera sessilis* reproduces only by stolon.

Cyperus rotundus dominated the early process of growth for three weeks. It was caused by rhizomes and seeds which were exposed to the sun. Thus, it

Table 1.Summed Dominan Ratio (SDR) Value (%) and Coefficient Community (C %) of Weeds at Harvest (3 Weeks After Planting)

No.	Weed species	Summed Dominan Ratio (SDR) Value (%)					
		JM	KT	TS 1	TS 2	TS 3	Average
1	*Cyperus rotundus*	50.79	51.93	51.24	52.81	49.79	51.31
2	*A. sessilis*	7.07	6.83	12.47	5.36	12.44	8.83
3	*A. conyzoides*	5.23	7.93	6.45	8.13	6.21	6.79
4	*C.rutidosperma*	7.02	5.07	5.66	6.85	4.11	5.74
5	*D.aegyptium*	6.30	5.74	4.58	3.77	1.38	4.35
6	*E.colona*	2.24	0.77	3.56	3.53	6.49	3.32
7	*G.globosa*	3.76	3.05	2.21	3.14	4.01	3.23
8	*P.urinaria*	3.44	2.84	2.92	3.45	0.62	2.66
9	*A.spinosus*	3.51	2.64	0.90	1.25	3.55	2.37
10	*Eleusin indica*	2.50	2.71	3.04	0.78	1.99	2.21
11	*Panicum sp.*	1.88	0.75	0.65	1.81	5.19	2.05
12	*Cleome viscose*	1.94	2.42	1.70	1.15	1.15	1.67
13	*Croton hirtus*	2.91	2.39	0.52	1.87	0.52	1.64
14	*Physalis angulata*	1.40	0.57	2.79	1.62	0.52	1.38
15	*Digitaria bicornis*	0.00	2.54	0.83	1.17	0.61	1.03
16	*E.prunifolia*	0.00	1.20	0.00	2.05	0.53	0.76
17	*Cosmos caudatus*	0.00	0.60	0.00	0.00	0.52	0.22
18	*A.vaginatum*	0.00	0.00	0.48	0.00	0.40	0.18
19	*Eclipta alba*	0.00	0.00	0.00	0.73	0.00	0.15
20	*Sida veronicifolia*	0.00	0.00	0.00	0.55	0.00	0.11
C = Coefficient community of sweet corn (%)			**91.11**	**88.38**	**89.09**	**83.77**	

Note: JM : Monoculture of sweet corn
KT : Monoculture of peanut
TS 1: Intercropping of sweet corn + peanut with proportion of 1:1
TS 2: Intercropping of sweet corn + peanut with proportion of 1:2
TS 3: Intercropping of sweet corn + peanut with proportion of 1:3

stimulated the buds. According to Gardner *et.al*, (1991), light is a triggering factor in breaking certain kinds of dormancy. Generally, soil moisture in the field capacity is optimum to germination. Dormancy of the seeds and rhizomes is broken when the land condition is suitable for germination.

Cyperus rotundus had spread over the land before the seeds of sweet corn-peanut were planted. It was good in competition and it prevented growth of other weeds. Moenandir (1990) said that the strength of weeds in competition was influenced by its characteristics, such as ability to regenerate and to produce numerous potential dormant seeds. On 3 weeks after planting, sweet corn was on the early stage of growth (3-5 leaves were completely open), so that high light intensity could reach the land surface. It was then utilitized by *Cyperus rotundus*. *Cyperus rotundus* is C-4 plants that suits living in outdoor with high light intensities.

The result of weeds vegetation analysis 7 weeks after planting showed that there were 21 types of weeds with *Alternanthera sessilis*as a dominant showing SDR value that reached 28,67% (Table 2). Other relative weeds were *Cyperus rotundus, Cleome rutidosperma, Ageratum conyzoides* and *Phyllantus urinaria* with SDR value of 17,89%, 12,50%, 9,06% and 7,49% respectively.

There was shift of dominant weeds because the sweet corn plants already reached maximum vegetative so that the canopy became lush. Weed spaces were shaded because the canopy hinders sunlight to reach the land surface and *Alternanthera*

Table 2. Summed Dominan Ratio (SDR) Value (%) and Coefficient Community (C,%) of Weeds at Harvest (7 Weeks After Planting)

No.	Weed species	Summed Dominan Ratio (SDR) Value (%)					
		JM	KT	TS 1	TS 2	TS 3	Average
1	*A. sessilis*	17.98	38.90	26.91	36.29	23.25	28.67
2	*Cyperus rotundus*	15.08	12.87	25.44	15.44	20.64	17.89
3	*C. rutidosperma*	11.67	13.34	8.82	14.45	14.20	12.50
4	*A.conyzoides*	9.68	9.96	8.24	6.89	10.52	9.06
5	*P.urinaria*	18.46	4.70	8.77	3.22	2.32	7.49
6	*Croton hirtus*	4.90	5.53	0.98	5.64	6.14	4.64
7	*Panicum lutescens*	9.07	0.83	3.60	0.60	3.28	3.47
8	*A. spinosus*	3.54	1.95	3.96	3.70	3.61	3.35
9	*E.colona*	1.26	3.02	1.66	3.75	2.18	2.38
10	*Phyllanthus sp.*	1.30	1.53	3.16	1.32	3.73	2.21
11	*D. aegyptium*	0.38	2.69	2.66	0.62	3.16	1.90
12	*Cosmos caudatus*	1.44	0.00	1.22	1.57	1.86	1.22
13	*Aneilema spiratum*	1.00	1.49	0.00	0.99	1.32	0.96
14	*E. prunifolia*	0.00	0.65	0.79	1.66	1.19	0.86
15	*Euphorbia hirta*	0.00	0.00	0.00	3.13	0.00	0.63
16	*Physalis angulata*	1.97	0.59	0.53	0.00	0.00	0.62
17	*G. celosioides*	0.00	0.00	2.14	0.75	0.00	0.58
18	*P. dichotomiflorum*	0.00	0.73	1.11	0.00	0.65	0.50
19	*Oxalis barrelieri*	0.00	0.00	0.00	0.00	1.95	0.39
20	*A.pertusus*	1.19	0.59	0.00	0.00	0.00	0.36
21	*U.panicoides*	1.15	0.62	0.00	0.00	0.00	0.35
C = Coefficient community of sweet corn (%)			**70.33**	**71.70**	**69.25**	**73.83**	

Note: JM : Monoculture of sweet corn
KT : Monoculture of peanut
TS 1: Intercropping of sweet corn + peanut with proportion of 1:1
TS 2: Intercropping of sweet corn + peanut with proportion of 1:2
TS 3: Intercropping of sweet corn + peanut with proportion of 1:3

sessilis is kind of wide leave weeds that can grow in shade areas.

Characteristic of *Alternanthera sessilis* is different from that of *Cyperus rotundus*. *Alternanthera sessilis* is kind of annual leavy weeds that live on the land, creep and reproduce by seeds and stolon. Stolon creeping on the land has buds and roots for regeneration (Mangoensoekarjo and Soejono, 2015).

The result of weeds vegetation analysis 9 weeks after planting showed that there were 26 types of weeds. There was significantly additional number of weeds, which was *Alternanthera sessilis* as the most dominant (table 3). Other relatives dominant weeds, were *Ageratum conyzoides*, *Cyperus rotundus*, *Amaranthus spinosus* and *Cleome rutidosperma* with SDR value of 13.32%, 12.18%, 9.48% and 7.45% respectively. This indicates that the wide leave weeds were dominant from 7 weeks to 10 weeks after planting. While *Cyperus rotundus* weeds were relatively dominant in all age of observation.

This addition might because weeds have diverse dormant period of seed as well as diverse growth time and germination. This is supported by Tjitrosoedirjo et al. (2010) who said that weeds species have different dormant period of seeds. Meanwhile, Anaya (1999) argued that the age of plant affected production of allelopathicic compounds, optimum grown weeds produce more allelopatics than young or old weeds.

Some of relatively dominant weeds have differ-

Table 3. Summed Dominan Ratio (SDR) Value (%) and Coefficient Community (C %) of Weeds at Harvest (9 Weeks After Planting)

No.	Weed species	Summed Dominan Ratio (SDR) Value (%)					
		JM	KT	TS 1	TS 2	TS 3	Average
1	*Alternanthera sessilis*	16.51	11.29	30.04	17.91	27.21	20.59
2	*Ageratum conyzoides*	11.45	13.08	12.00	17.32	12.77	13.32
3	*Cyperus rotundus*	10.07	13.65	13.53	16.35	7.30	12.18
4	*Amaranthus spinosus*	11.71	19.13	2.59	6.62	7.33	9.48
5	*Cleome rutidosperma*	4.63	8.05	7.38	10.86	6.32	7.45
6	*D. aegyptium*	13.68	3.97	4.10	0.67	0.00	4.49
7	*Urochloa panicoides*	5.96	5.07	2.74	4.92	2.73	4.28
8	*Gomphrena globosa*	1.77	4.22	3.82	3.80	7.36	4.20
9	*Euphorbia prunifolia*	0.37	5.32	2.75	2.72	4.90	3.21
10	*Digitaria bicornis*	6.17	0.00	4.87	3.14	1.28	3.09
11	*P. dichotomiflorum*	4.21	3.49	0.83	2.75	3.44	2.94
12	*Physalis angulata*	0.00	4.50	1.72	1.11	4.38	2.34
13	*Phylantus urinaria*	2.01	0.68	3.45	0.80	2.17	1.82
14	*Aneilema vaginatum*	1.63	0.00	3.40	0.76	2.08	1.57
15	*Euphorbia hirta*	1.63	1.02	1.04	2.39	0.64	1.34
16	*Echinochloa colona*	0.00	0.83	0.00	2.37	3.20	1.28
17	*Phyllantus sp.*	0.45	1.94	0.68	1.76	0.76	1.12
18	*Cosmos caudatus*	0.00	1.32	1.46	0.00	2.00	0.96
19	*Croton hirtus*	1.44	1.96	0.00	0.66	0.54	0.92
20	*Eleusin indica*	2.23	0.00	0.00	0.00	2.34	0.91
21	*O.burmanniana*	2.06	0.46	0.00	0.61	0.00	0.63
22	*Panicum lutescens*	0.48	0.00	2.42	0.00	0.00	0.58
23	*Sida veronicifolia*	0.00	0.00	0.51	1.74	0.00	0.45
24	*Eclypta alba*	0.00	0.00	0.66	0.00	1.22	0.38
25	*Oxalis barrelieri*	0.45	0.00	0.00	0.72	0.00	0.23
26	*Aneilema spiratum*	1.11	0.00	0.00	0.00	0.00	0.22
C = Coefficient community of sweet corn (%)			**67.86**	**65.53**	**68.26**	**64.30**	

Note: JM : Monoculture of sweet corn
KT : Monoculture of peanut
TS 1: Intercropping of sweet corn + peanut with proportion of 1:1
TS 2: Intercropping of sweet corn + peanut with proportion of 1:2
TS 3: Intercropping of sweet corn + peanut with proportion of 1:3

ent ecology and characteristics. *Cyperus rotundus* was relatively dominant in all of observation because of its ecology. According to Mangoensoekarjo and Soejono (2015), *Cyperus* could survive under the shade or dry-out up to an altitude of 1000 m above sea levels.

Amaranthus spinosus is known as 'bayam duri' or spiny pigweed, which is a herb with wide leaves growing upright and it is a year old. *A. spinosus* has many branches and thorns and it reproduces generatively using seeds (Van Steenis, 2003). Holm et al. (1997) said that *A Spinosus* is the type of weeds that produce seeds in high amount, which is 235.000 seeds per plant. *A. Spinosus* is a weed that applies photosynthesis C-4 (Sastroutomo, 1990).

*Ageratum conyzoides*is known as billy goat weed, which is a herb with large leaves growing upright a year of life cycle. It also reproduces generatively using seeds. According to Holm et al. (1977), *A. Conyzoides* is a weed that produces 40.000 seeds

per plant. *A. Conyzoides* contains allelo-chemical compound of natural alkaloid, coumarin, and terpenoids (Djauhariya and Hermani, 2004).

Coefficient of Weeds Community

Coefficient community value of weeds (C) 3 weeks after planting (WAP) showed that comunity of weed was homogent on sweet corn-peanut intercropping proportions 1:1, 1:2, and 1:3 with C value of 88,38%, 89,09% and 83,77% respectively. Coefficient community of weeds are presented in Table 1. The C value 3 weeks after planting was more than 75%, meaning that composition of weeds community in sweet corn-peanut intercropping was homogenous compared to that in sweet corn monoculture. In three weeks after planting, canopy of sweet corn and peanut were not covered by each other yet, so that the weed composition was not affected as shown by its coefficient community.

C values of weeds at 7WAP and 9WAP which were lower than 75% showed that comunity of weeds was heterogenous in sweet corn-peanut intercropping. It indicated that the composition of weed community in sweet corn-peanut intercropping was heterogenous compared to that in sweet corn monoculture (Table 2 and Table 3).

The heterogeneity was caused by the difference of weeds growing space. Existence of peanuts among sweet corns could decrease the sunlight intensity transmitted on the land surface of land, so that diverse micro climate was created. This condition also created different response towards growing species of weeds. This is in line with Aldrich (1984) *cit.* Endang (2010) who said that each species of weeds has different ability to respond the availability of growing factors, such as water, nutrient, light, and CO_2, which are in shortage.

Weeds Analysis

The result of variance at 3WAP showed that intercropping of sweet corn and peanut did not influence number of individuals, number of species, and dry weight of weeds. The average of the number of individuals, number of species and dry weight of weeds were presented in Table 4. When weeds were 3 weeks old, the canopy of plants (sweet corns and peanuts) couldn't cover the growing space of weeds because plants were in an early phase of growth.This condition allows weeds to freely grow. It was also supported by homogenous environmental conditions, so that different population did not affect the weeds especially number of individual, species, and weed biomass.

In 3 weeks after planting, *Cyperus rotundus* was dominant all over the fields. *Cyperus rotundus* spread evenly and grew suppressing other weeds. Usually, the type of wide leaves weeds couldn't grow in a season because the seeds were unable to germinate by due to the existence of *Cyperus rotundus.*

The result of analysis of variance at 7 WAP showed that all of treatments couldn't affect the number of individual, number of species, and dry weight of weeds (Table 5).

Table 5 showed that in sweet corn-peanut intercropping, the number of individual tended to decrease while the number of weed species tended to increase following the increase of the proportion of peanuts.When sweet corn plants were entering maximum vegetative growth phase, the growth of peanut plants was hindered by the canopy of sweet corn. The light that was intercepted under sweet corn canopy caused stems of peanut stalks spreading over the ground toward coming light direction. This condition caused the canopy of peanuts could not cover the surface of land optimally allowing weeds to grow properly. Quantitatively, the number of individual weeds was not similar to its dry weight. In other words, the high number of individual weed does not necessarily indicate that its weight is high as well. Similar to cultivated plants,

Table 4. The Average of Number of Individual, Number of Species, and Dry Weight of Weeds at Harvest (3 Weeks After Planting)

Treatments	Number of individuals*	Number of species*	Dry weight (g/0,25 m²)*
JM	322.67	19.667	95.72
KT	484.00	19.333	122.04
TS 1	381.00	20.000	115.42
TS 2	481.67	23.333	114.15
TS 3	257.00	17.667	84.07

Note: *The value show non-significant difference at α 5%
JM : Monoculture of sweet corn
KT : Monoculture of peanut
TS 1: Intercropping of sweet corn + peanut with proportion of 1:1
TS 2: Intercropping of sweet corn + peanut with proportion of 1:2
TS 3: Intercropping of sweet corn + peanut with proportion of 1:3

Table 5. The Average of Number of Individual, Number of Species, and Dry Weight of Weeds at Harvest (7 Weeks After Planting)

Treatments	Number of individuals*	Number of species*	Dry weight (g/0,25 m²)*
JM	348.33	21.667	131.63
KT	337.67	20.667	136.48
TS 1	303.00	20.667	99.91
TS 2	292.33	19.333	116.73
TS 3	221.00	21.000	86.18

Note: *The value show non-significant difference at α 5%
JM : Monoculture of sweet corn
KT : Monoculture of peanut
TS 1: Intercropping of sweet corn + peanut with proportion of 1:1
TS 2: Intercropping of sweet corn + peanut with proportion of 1:2
TS 3: Intercropping of sweet corn + peanut with proportion of 1:3

Table 6. The Average of Number of Individual, Number of Species, and Dry Weight of Weeds at Harvest (9 Weeks After Planting)

Treatments	Number of individuals*	Number of species*	Dry weight (g/0,25 m²)*
JM	316.00 a	27.667 a	219.02 ab
KT	107.33 c	20.667 a	248.39 a
TS 1	226.33 ab	22.667 a	113.26 bc
TS 2	163.00 bc	21.667 a	98.11 c
TS 3	130.67 bc	20.000 a	114.42 bc

Note: Numbers followed by the same letter at the same column show non-significant difference at α 5%.
JM : Monoculture of sweet corn
KT : Monoculture of peanut
TS 1: Intercropping of sweet corn + peanut with proportion of 1:1
TS 2: Intercropping of sweet corn + peanut with proportion of 1:2
TS 3: Intercropping of sweet corn + peanut with proportion of 1:3

weeds have the ability in photosynthesis pathway C-3, C-4 and CAM, depending on its species. Each species has different ability in forming biomass.

C-3 weeds generate one gram of dry material used by water of 500-1.068 g (water extravagance) with lower intensity of light, while C-4 weeds need 250-350 g of water and are unable to stand shade. Furthermore, weeds that have pathway of *crassulaceae* acid (CAM) only take carbon dioxide in the night (Mangoensoekarjo and Soejono, 2015). *Cyperus rotundus, Amaranthus spinosus,* and *Echinochloa colonum* have the similar pathway of photosynthesis C-4, while *P. dichotomum, A. Repens*, *Alternanthera sessilis*have follow pathway of photosynthesis C-3, and *Euphorbiaceae* is the same as CAM (Mangoensoekarjoand Soejono, 2015).

The result of analysis of variance showed that intercropping of sweet corn and peanut with the proportion of 1:2 at 9 WAP significantly influenced the number of individual weed and dry weight of weed and it was compared to the monoculture of sweet corn. However, it did not affect the number of weed (Table 6). It was because the existence of peanut among sweet corn with 1:2 proportion

Table 8. Components of Peanut Yields: Number Pod and Weight of Dry Seed

Treatments	Peanut	
	Number of Pod	Weight of Dry Seed (g/plant)
JM	-	-
KT	10.44 a	8.01 a
TS 1	14.22 a	8.40 a
TS 2	10.22 a	6.13 ab
TS 3	7.44 a	3.99 b

Note: Numbers followed by the same letter at the same column show non-significant difference at α 5%.
JM : Monoculture of sweet corn
KT : Monoculture of peanut
TS 1: Intercropping of sweet corn + peanut with proportion of 1:1
TS 2: Intercropping of sweet corn + peanut with proportion of 1:2
TS 3: Intercropping of sweet corn + peanut with proportion of 1:3

Table 9. Average Yield of Sweet Corn and Peanut, and LER (Land Equivalent Ratio)

Treatments	Yield (ton/ha)		LER
	Sweet corn	Peanut	
JM	8.25 a	-	-
KT	-	1.27 a	-
TS 1	9.20 a	0.29 b	1.34 a
TS 2	8.16 a	0.31 b	1.26 a
TS 3	12.71 a	0.45 b	1.89 a

Note: Numbers followed by the same letter at the same column show non-significant difference at α 5%.
JM : Monoculture of sweet corn
KT : Monoculture of peanut
TS 1: Intercropping of sweet corn + peanut with proportion of 1:1
TS 2: Intercropping of sweet corn + peanut with proportion of 1:2
TS 3: Intercropping of sweet corn + peanut with proportion of 1:3

could suppress the weeds growth. On the other hand, the existence of peanut in intercropping with proportion 1:1 and 1:3 could not suppress the weed growth because the plant spacing was too large and the canopy could not cover the space of weed optimally.

In intercropping system, peanut plant becomes a barrier of sunlight to reach the land surface, so there are competitions between peanut and weed to obtain the light. Weeds who lose in the competition will be increasingly depressed. It causes only few of weed to grow up. Moenandir (1998) said that the pressing growths of a plant and weed will become inhibitors toward one another. Weed growth rate could not be developed causing weeds to be depressed, vice versa. Ilham (2014) said that the sunlight which was unblocked was very influential toward the growth of weeds since sunlight is as a main energy resource for photosynthesis.

According to Sastroutomo (1990), the first competition happened on the most limited growth. Besides, leaves growth stadium of weeds would affect the process of photosynthesis. Lakitan (2013) said that the ability of leaves to conduct photosynthesis was increased in early growth of a leaf, then it was decreased occasionally before completely developed. A leaf that begins to be in senescence will turn yellow and lose its ability to conduct photosynthesis because the chlorophylls reshuffle and lose ~~its~~ their chloroplast function. The slower the photosynthesis of the weeds, the lower the weeds biomass produced.

Component of Sweet Corn Yields

The result showed that all treatments have non-significant difference from its monoculture on number of cob, weight of cob with husk, and weight of economic sweet corn cob (Table 7). This

is because growth of sweet corn on intercropping gave the relatively same yield with its monoculture. Available photosynthates were distributed more for seed formation so that the rate of cob formation was as high as that of seed filling.

Table 7 showed that yield components of sweet corn tend to increase along with the increase of peanuts population was increased. The reason was that sweet corn plants which were intercropped got supply of nitrogen from peanuts during generative phase. Therefore, it fulfiiled the need of nitrogent for sweet corn during the phase of cobs filling. Sweet corn produces one cob each plant averagely.

Component of Peanut Yield

The result showed that all treatments have non-significant difference on number of pod, but there was significant difference on the weight of dry seed peanut (Table 8). Table 8 showed that intercropping with proportion 1:3 obtained lowest weight of dry seed. It was because the competition between plants and weeds occurred in the phase of pods filling. There were several species of weeds that secreted allelopathy, which inhibited the pods filling process. Before harvest, weeds densely grew causing higher competition and inhibited peanutes growth so that the peanut yield was decreased.

There was high competition between both individual plants and weeds in the peanut population in intercropping with proportion 1:3. Gardner et al. (1991) said that the high density of plants would decrease number of seeds as well as decrease yields in seeds form because the competition of both plants got worse when it blossomed.

Yields of Sweet Corn and Peanut, and LER

The result showed that the yield of sweet corn among all treatments were not significantly different (Table 9). Both monoculture and intercropping produce the number of cubs as high as the weight of cubs so the yields in hectare area was evenly same.

Table 9 showed that sweet corn yields produced in monoculture were lower than potential yield, which was 18 ton/ha. The yield of sweet corn was not optimum because the weeds were not controled. Weeds could grow up freely in sweet corn area.

In table 9 showed that the yield of intercropping sweet corn which proportion 1:3 was tend to high amount 12.71 ton/ha. Allegedly, both of sweet corn and peanut were mutualy symbiotic with mycorrhiza and root's bacteria which support the corn plantson growth and generative phase.

The analysis result showed that the yield of peanut among all treatments were significantly different. Table 9 showed that highest yield of peanut was on monoculture, which was 1.27 ton/ha. The average of peanut yield in all treatments has not reached the potential yield of cv. 'kancil' yet (1.7 ton/ha). This was because the population of peanuts on intercropping with proportion 1:3 was higher than that with proportion 1:1. Therefore, the quantity of peanut yield was higher as well. Hendrival et al.(2014) said that the competition of weeds in early growth would decline the yield quantity, while the competition before harvest would influence the yield quality.

LER (Land Equivalent Ratio) is counted in order to know the success level of intercropping related to its land productivity. Table 9 showed that all proportion of sweet corn and peanut intercropping have LER value > 1, which means that productivity of land intercropping is higher than monoculture.

The analysis result of LER showed that all of intercropping proportion were not significantly different, which value is more than one (LER > 1). Table 9 showed that intercropping with proportion 1:3 was able to produce the highest LER, which was 1.89. Intercropping is able to increase efficiency

of land use compared to monoculture, as well as it raises productivity of land. On the same land area, various kinds of plants can be planted. Intercropping of sweet corn and peanut with proportion 1:3 resulted higher productivity than intercropping with proportion 1:1 and 1:2.

CONCLUSION

Intercropping of sweet corn-peanut with proportion 1:2 could decrease the weeds growth on 9 weeks after planting (when harvest) without decreasing the sweet corn yields.

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