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THE EFFECT OF CROP PROPORTION IN ROW INTERCORPPING OF CORN (*ZEA MAYS*) AND SOYBEAN (*CLYCYNE MAX L. MERR*) ON THEIR GROWTH AND YIELD PERFORMENCES

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RINGKASAN

Suatu percobaan lapangan telah dilakukan untuk mengkaji pengaruh proporsi tanaman dalam tumpangsari larikan antara kedelai dan jagung terhadap pertumbuhan dan hasilnya, serta hubungan antara sifat-sifat agronomis dan hasil sebagai pengaruh proporsi tanaman tersebut.

Enam pola tumpangsari larikan jagung-kedelai dengan proporsi yang berlainan mengikuti pola seri penggantian dengan selang 20%, yaitu perbandingan jumlah larikan jagung/kedelai : 0/5; 1/4; 2/3; 3/2; 4/1 dan 5/0 dievalusi menggunakan Rancangan Acak Kelompok Lengkap (RAKL) dengan tiga blok sebagai ulangan. Jarak tanam antar larikan adalah 75 cm dan dalam larikan adalah 25 cm untuk jagung dan 6,25 untuk kedelai. Ukuran petak yang digunakan adalah 6 m x 11,25 m.

Pengamatan dilakukan terhadap tinggi tanaman, umur tanaman, index luas daun, hasil, komponen hasil dan rasio kesetaraan lahan. Data yang diperoleh dianalisis dengan analisis varian dan analisis korelasi.

Hasil percobaan menunjukkan bahwa kecuali jumlah cabang produktif, jumlah larikan biji pada tongkol dan index panen, semua parameter agronomi dan hasil secara nyata dipengaruhi proporsi tanaman dalam tumpangsari. Semakin rendah proporsi tanaman jagung dalam tumpangsari mengakibatkan secara nyata bentuk tanaman jagung lebih pendek, umur tanaman lebih panjang, hasil tanaman lebih besar, jumlah biji tiap larik pada tongkol meningkat, panjang tongkol meningkat dan rasio kesetaraan lahan meningkat. Semakin rendah proporsi tanaman kedelai dalam tumpangsari secara nyata mengakibatkan tanaman kedelai tumbuh lebih tinggi, umur tanaman lebih panjang, hasil menurun dan rasio kesetaraan lahan dalam sistem ini menurun. Index luas daun pada kedua jenis tanaman tidak secara nyata dipengaruhi oleh variasi proporsi tanaman.

ABSTRACT

A field experiment was done to study the effect of crop proportion in corn-soybean intercropped in rows on their growth and yield performances and correlation among those parameters as well. Six in row corn-soybean intercropped at varrying proportions corresponding to a replacement series of 20% interval, i.e. ratio of corn-soybean row at 0/5, 1/4, 2/3, 3/2, 4/1, and 5./0 were evaluated in a Randomized Completely Block with three blocks as replicates. Rows were spaced at 75 cm. Within row spacing was 25 cm corn and 6.25 cm for soybean. Plot size of 6 m x 11.25 m was used.

Records were made on plant height, plant age, leaf area index, yield and yield components, and land equivalent ratio. The data were subjected to analysis of variance and correlation analysis.

The results showed that except for the number productive branches of soybean, seed row number per ear in corn, LAI and HI, all other parameters were significantly affected by crop proportion in the intercrop. Lower proportions of corn in the system resulted significantly to lower stature of corn plants, longer plant age, higher yield per plant due to longer ear, higher number of seeds per row, and higher LER.

Lower soybean proportion in the system resulted significantly to taller soybean plants, longer plant age, lower yield, and lower LER.

INTRODUCTION

Corn and soybean are usually grown as either monoculture or intercrops. Through intercropping system, land utilzation is intensive resulting in higher Land Equivalent Ratio (LER) and higher Gross Return Investement (Beets, 1982). In addition, other advantages : minimum

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soil erotion and maintainance of soil fertility could also be derived (Ginting and Yusuf, 1983).

In intercropping, the occurence of intra and interspecific competition could not be avoided. This competition would affect growth and development of each crop in the system. Corn plant height, days to tasseling, silking and maturity, yield and yield components, and lastly seed quality (Okigbo, 1975) might be affected. Increase partial shading the taller crop gives to the lower crop and hence decrease of agronomic characters of the lower crop might result (Wahua and Miller, 1978).

Leaf Area Index and Leaf Density of soybean is higher when planted under shelter in dryland condition (Ogbuchi and Brandle, 1982). With respect to solar radiation, Sibles and Weber, (1985) had found that in soybean crops, percent interception of solar radiation and rate of dry matter production increased with the increase of LAI. Similar result was found by Dalal (1978) in corn. further study of Saxena and Chandle (1986) indicated that intercropping reduced LAI in the range of 9 to 51% for soybean and 3 to 55% for corn. Enyi (1973) had a view that reduction of corn grain yield in intercropping appears mainly due to the decrease of LAI.

Growing corn and soybean in intercropped in alternate rows gave higher LER, compared to mix-cropping (Allen and Obura, 1983). Several corn and soybean intercropping experiments showed that LER ranged from 1.04 to 1.44 (Jana and Sekao, 1976; Osiru and Willey, 1976; Cordero and McCollum, 1979; Gomez and Gomez, 1980).

The aims of the present study are to find out the effect of proportion of corn and soybean being intercropped in row intercropping on their morpho-physiological characters and how intercrop proportion related to agronomic characters and yields.

MATERIAL AND METHOD

Corn (IPB var. 1) and soybean (UPLB Sy-2) seeds, obtained from Institue of Plant Breeding (IPB-UPLB), were grown in row intercropping in the dry season. Perforated irrigation and row irrigation was provided respectively during vegative phase and reproductive phase.

Six corn-soybean intercrops of varying proportions corresponding to a replacement series of 20% interval (Tabel 1) were evaluated in a Randomized Completely Block Design (RCBD) with three blocks as replicates. Crop rows were spaced at 75 cm with within row of 25 cm for corn and 6.25 cm for soybean. Plots of size 6.0 x 11.25 m^2 were used.

Table 1. Six of corn and soybean in intercorps.

No.	Treatment code	Crop proportion (based on row number in a plot)	
		Corn	Soybean
1	C5	five rows of corn (100%)	
2	C4S1	four rows of corn (80%)	one row of soybean (20%)
3	C3S2	three rows of corn (60%)	two rows of soybean (40%)
4	C3S3	two rows of corn (40%)	three rows of soybean (60%)
5	C1S4	one row of corn (20%)	four rows of soybean (80%)
6	S5		five rows of soybean (100%)

Observations were made on twelve agronomic characteristics of corn and corn yield, and ten agronomic charateristics of soybean. Data collected were subjected to an analysis of varience and correlation analysis.

RESULT AND DISCUSSION

In this experiment, the possible competition were mainly on solar radiation for the lower crop, the soybean, due to partial shading from the taller crop, the corn plants. Other aspect which might changed were temperature within inter-

cropped plants. Higher proportion of corn in the intercropped to higher temperature, as the air below corn canopy remained stand still.

Irrigation was provided so that the intercropped would not suffer water stress conditions. The amount of irrigaiton water to be given were based weekly evaportranspiration, percolation and actual rainfall.

Means of data being collected were presented on Table 2 for soybean and Table 3 for corn. It showed that different corn proporties differently affected soybean growth parameters (i.e. plant height, plant age, no. of node, number of pods, yield per plant, and LER). Harvest Index and Leaf Area Index were not significantly affected by different proportion of corn.

index and leaf area index were not significantly affected by intercrop proportion in the system.

As in corn, harvest index is a conservative character of soybean and hence was not affected much by environmental conditions (Spaeth and Sincliar, 1984).

Results of correlation analysis were presented in Table 4 and Table 5. It is evident that lower proportion of soybean in the system resulted in significantly taller soybean plant height, longer date to maturity, lower yield either per plant or per unit area, and lower LER. With lower proportion of soybean plants, higher degree of partial shading would be experienced by crop of lower stature in the system, leading to longer plant age to flowering and hence maturity and gave

Table 2. The growth and yield of soybean plant as affected by different crop proportion in row intercropping with corn

Code	CP	PH	DMT	BP	NP	PP	YP	YH	HI	LER	LAI
C4S1	20	57.83 a	80 a	2.20 a	16.66 ab	21.23 b	5.93	253.51 c	0.45 a	0.94 b	2.30 a
C3S2	40	60.46 a	80 a	2.20 a	18.13 ab	27.67 ab	6.80 b	581.19 c	0.51 a	0.97 b	2.94 a
C2S3	60	60.50 a	79 b	2.07 a	15.90 b	21.90 b	9.31 a	1193.39 b	0.52 a	1.15 a	2.98 a
C1S4	80	49.08 b	77 bc	2.33 a	19.70 a	30.90 a	10.36 a	1769.20 a	0.52 a	1.18 a	2.77 a
S5	100	53.66 ab	76 c	2.27 a	17.70 ab	29.20 ab	9.39 a	2003.36 a	0.52 a	1.00 b	2.73 a

Table 3. The growth and yield of corn plant as affected by different crop proportion in row intercropping with soybean

Code	CP	PH	DT	DS	DMT	SRC	SR	EL	YP	YH	HI	LER	LAI
C5	100	156.54 a	45 c	50 c	91 b	13.56 a	25.11 c	12.59 c	91.26 b	4848.58 a	0.44 a	1.00 b	2.45 a
C4S1	80	151.94 a	46 bc	51 ab	91 b	13.66 a	26.22 bc	13.00 bc	92.52 b	3950.88 b	0.40 a	0.94 b	2.24 a
C3S2	60	147.05 bc	47 bc	51 ab	93 a	13.40 a	27.81 bc	13.13 b	101.19 a	3238.17 c	0.41 a	0.97 b	2.52 a
C2S3	40	141.55 bc	49 a	52 a	94 a	13.99 a	28.55 ab	14.14 ab	99.34 a	2119.27 d	0.39 a	1.05 a	2.74 a
C1S4	20	138.43 c	49 a	52 a	94 a	14.22	30.66 a	15.44 a	119.82 a	1278.09 e	0.44 a	1.15 a	2.75 a

Means in the same column, followed by the same letter are not significantly different under DMRT (α = 5%)

CP = crop production; PH = plant height; DT, DS, DMT = days to tasseling, silking, maturity; BP = productive branches; NP = nodes per plant; PP = pods per plant; YP = yield per plant; YH = yield per hectare; SRC = seeds row per cob; SR = seeds per row, EL = ear length; HI = harvest index; LER = Land Equivalent Ratio; LAI Leaf Area Index.

Corn, the taller crop in the system, was also affected by intercrop proportion in terms of plant height, plant age, number of seeds per row in an ear, ear length, yield per plant, yield per hectare and LER. Seed row number per ear, harvest

lower yield per plant, probably due to lower net assimilation rate. LAI had no signifacant correlation to other parameters being considered.

Lower portion of corn, the taller crop in the system, significantly reduced corn plant stat-

Table 4. Corelation coefficients among growth parameters and yields of soybean intercropped with corn in different proportions.

	CP	PH	BP	NP	PP	DMT	YP	YH	HI	LER
PH	-0.6351									
BP	0.4396	-0.1729								
NP	0.3965	-0.2685	0.6516							
PP	0.1129	-0.2363	-0.6303	0.8805						
DMT	-0.9746**	0.4410	-0.1063	-0.3289	-0.5006					
YP	0.8702*	-0.5820	0.0024	0.3881	0.5536	-0.9755**				
YH	0.9906**	-0.6983	0.4595	0.4380	0.7443	-0.2033	0.9871**			
HI	0.7770*	-0.2336	0.5395	0.2210	0.4244	-0.3075	0.7907	0.7588**		
LER	0.9630**	-0.7568	0.3588	0.6288	0.7224	-0.1694	0.9485**	0.9841**	0.6740	
LAI	-0.5101	-0.1845	-0.3002	0.1108	0.3435	-0.5171	0.5171	0.3067	0.7234	0.7527

* = significant at α = 5 % ** = significant at α = 1%

Table 5. Corelation coefficients among growth parameters and yields of corn inter-cropped with soybean in different proportions.

	CP	PH	DT	DS	DMT	SRC	SR	EL	YP	YH	HI	LER
PH	.9971**											
DT	-.9768**	-.5318										
DS	-.9149**	.5000	.8722*									
DMT	-.9619**	-.5411	.9755**	.7720								
SRC	.7831*	-.2003	.2791	.2422	.2493							
SR	-.9920**	-.7796*	.6901	.6741	.6534	.3141						
EL	-.9650**	-.7595*	.6331	.5682	.5979	.4217	.9158**					
YP	-.8830**	-.8429*	.7645	.7048	.7729*	.6971	.9361**	.8801*				
YH	.9981**	.7409	-.8530*	-.6909	-.8839*	-.2430	-.0125	-.7709	-.8749**			
HI	.0686	.0659	-.2405	-.3101	-.2274	.1836	0.125	-.0717	.3741	.0782		
YI	-.9630**	-.9427**	.9919*	.8614*	.8018*	.9280**	.9280**	.9902**	.9984**	-.9683**	.7184	
LER	-.8277*	-.8402*	.8119	.8119	.7142	.3256	.3256	.8741**	.5679	-.8337	.1650	.8506

* = significant at α = 5 % ** = significant at α = 1%

ure resulting longer plant age, more seeds per row, longer ear length, higher yield per plant, and higher LER. Leaf Area Index had significant correlation to plant age, yield components, and plant height. Higher LAI of corn plant significantly led to longer plant age, higher yield and yield components, shorter plant stature under with lower corn proportion.

CONCLUSION

Based on the experimental results it can be concluded that :

1. Exept for productive branch number in soybean, seed row number in corn and harvest index of the two crops, all other agronomic characteristics being studied were significantly affected by crop proportion in intercropping.

2. Lower proportion of corn in the system significantly led to shorter plant stature, higher LAI, longer plant age, hinger yield per plant and higher Land Equivalent Ratio.

3. Lower proportion of soybean in the system significantly caused longer plant age, taller plant stature, lower yield and LER, but did not affect leaf aea index.

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USAHA MENINGKATKAN KUANTITAS DAN KUALITAS HASIL BENIH KACANG HIJAU (*Vigna radiata* (L.) Willczek) DENGAN INOKULASI RHIZOBIUM DAN PUPUK TSP

Oleh :
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ABSTRACT

The experiment was aimed to study and effort to improve quantity and quality of mungbean seed by *Rhizobium* inoculation and phosphate fertilizer. The research was conducted at Laboratory of Seed Technology, Faculty of Agriculture, Gadjah Mada University and Nogotirto field, Sleman from September to December 1994.

A factorial experiment was used and arranged in Randomized Complete Block Design with three replications for quantity of seed test in the field and Completly Randomized Design with four replications for quality of seed test in the laboratory. The experiment applied *Rhizobium* inoculation and no *Rhizobium* combined with four levels of TSP at 0, 45, 90 and 135 kg/ha.

The result of this experiment indicated that the application of *Rhizobium* could improve the quantity and quality of mungbean seed. Phosphate fertilizer increased the quantity and quality of mungbean seed yield by the application of TSP at 45 kg and 90 kg/ha.

PENDAHULUAN

Kacang hijau mempunyai peranan penting dalam perbaikan mutu gizi masyarakat Indonesia yang pada umumnya konsumsi protein rata-ratanya masih rendah. Kacang hijau mengandung karbohidrat, protein dan vitamin B yang tinggi. Pengadaan palawija antara lain kacang hijau merupakan salah satu program penunjang usaha swasembada beras. Oleh sebab itu dalam rangka peningkatan produksi kacang hijau diperlukan pengadaan benih dengan kuantitas dan kualitas tinggi. Perbaikan teknik budidaya berupa pemupukan adalah salah satu cara yang penting.

Tanaman kacang hijau merupakan tanaman yang mengandung protein dan vitamin B yang tinggi, untuk menghasilkan benih yang baik diperlukan nitrogen dalam jumlah yang banyak. Percobaan Fatchurochim (1975) *cit.* Fatchurochim (1982) memberikan hasil bahwa lebih dari 90% N ditranslokasikan ke benih dari bagian-bagian vegetatif, sehingga kandungan N selama perkecambahan benih kacang hijau juga tinggi. Suatu keuntungan bahwa di dalam bintil akar tanaman kacang-kacangan seperti kedelai, kacang hijau, dan kacang tanah, terjadi kerjasama antara tanaman dengan bakteri Rhizobium yang melakukan penyematan N_2 udara sehingga dapat digunakan tanaman (Vest *et al.*, 1976). Gagampang (1975) *cit.* Setya Adi (1989) melaporkan bahwa pada tanah dengan kandungan N rendah bakteri Rhizobium dapat menyemat 2/3 bagian yang dibutuhkan tanaman, sedang tanah dengan kandungan N tinggi hanya disemat kurang dari 1/4 bagian. Ditunjukkan pula bahwa penyematan N rata-rata dalam satu musim tanam pada tanaman kedelai 63 kg/ha, kacang hijau 40 kg/ha, dan kacang tanah 45 kg/ha. Selanjutnya dijelaskan bahwa efektivitas fiksasi N_2 oleh bakteri Rhizobium ditentukan pula oleh ketersediaan unsur hara lain, misalnya unsur Phosphat (P).

Unsur P berpengaruh terhadap kandungan P total benih terutama dalam bentuk fitin (90%). Fitin berfungsi sebagai cadangan fosfor dan untuk pemelihara energi yang sangat diperlukan selama proses perkecambahan (Copeland, 1976). Unsur P terdapat dalam tanaman sebagai penyusun asam nukleat, fosfolipid, koensim NAD dan NADP, dan yang terpenting sebagai penyusun ATP. Unsur P sangat diperlukan untuk pertumbuhan generatif seperti pembentukan bunga dan bagian-bagiannya yang akan menjadi buah dan biji. Adanya unsur P juga mendorong bertambah me-

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