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Interactive effect of intercropping systems and fertility levels on yield and economics of summer cowpea intensified with baby corn

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Abstract

An experiment was conducted during *Summer* season of 2019 and 2020 at Agricultural Research Station, Agriculture University, Kota, Rajasthan, India to study the interactive effect of intercropping systems and fertility levels on yield and economics of summer cowpea intensified with baby corn. There are thirty treatment combination with five intercropping systems [sole cowpea, sole baby corn, cowpea + baby corn (2:1), cowpea + baby corn (3:1) and cowpea+ baby corn (4:1)] in main plot, three fertility levels (100, 125 and 150% RDF) in sub plot and two stress mitigating chemicals (0.5% $CaCl_2$ and 1% KNO_3 at flowering and pod development stage of cowpea) in sub-sub plot and replicated four time. Interactive effect was exists within the intercropping systems and fertility levels. Data showed that the significantly higher cowpea equivalent yield gross returns, net returns and B:C ratio was recorded in cowpea and baby corn 2:1 row ratio fertilized with 150% RDF over rest of the treatment combinations.

Key words : Cowpea baby corn intercropping system, Economics, Fertilization, RDF, Yield

Introduction

Cowpea (*Vigna unguiculata* L.) also called as *Lobia* is one of important summer pulse crop grown for grain, green manuring and forage. This crop give such a good vegetative growth and covers the ground so well. It has considerable promise as an alternative pulse crop. Cowpea is grown as intercrop, mixed crop, catch crop, mulch crop and green manure crop. It is good source of protein (20-25 %). Baby corn (*Zea mays* L.) is a new addition to Indian food. Because of a short duration crop, baby corn easily fits in an intensive cropping system and in addition to its cob it provide a nutritive green fodder to cattle (Das *et al.* 2008). Baby corn is dehusked maize ear, harvested within 2-3 days of silk emergence but prior to fertilization and it is consumed as vegetable due to its sweet flavour. Great nutritional value, eco-friendly and crispy nature of baby corn has made it special choice for many traditional and continental dishes apart from canning in the elite society (Singh *et al*., 2006).

Intercropping is a system of managing of crops which includes growing of two or more different crop species or varieties simultaneously in distinct row arrangement on the same piece of land. It is a simple but inexpensive policy and has been recognized as a potentially benefited technology for increased crop production (Awal *et al.*, 2006). The most common advantage of intercropping is the production of greater yield on a given piece of land by making more efficient use of the available growth resources using a mixture of crops of different rooting ability, canopy structure, height and nutrient requirement based on the

complementary utilization of growth resources by the component crops.

Declining soil nutrient has been quoted as the main basis of low crop yields in most parts of India. Crop demand for nutrients is encountered by a combination of inherent fertility of soil and the nutrients which are externally applied. For high yielding crops with high capacity of dry matter buildup and having the high rates of nutrient uptake such as maize, soil must allow unrestricted root growth and be able to supply nutrients at the rate for maximum growth. Nitrogen is a keystone for plant growth and also more complex one seeing all of the possible forms and processes in its cycle (Montemurro and Diacono, 2016). It is a necessary and important determinant for growth and development of crop plants (Tanaka *et al.*, 1984). Nitrogen is also an universally deficient plant nutrient in most of the Indian soils, particularly in the light textured areas (Chhonkar and Rattan, 2000). Phosphorus is an essential nutrient because it is a part of a number of key plant structure compounds and as a catalysis in the conversion of various key biochemical reactions in plants. Phosphorus is noted especially for its role in capturing and converting the sun's energy into useful plant compounds. It is a vital component of DNA, the genetic "memory unit" of all living things.

Meterial and Methods

Field experiments were conducted during summer seasons of 2019 and 2020 in Kota, Rajasthan, India at agriculture research station, Ummedganj, Kota under Agriculture University, Kota (25°13' N latitude and 75°28' E longitude at an altitude of 271 m above the mean sea level). The experiment was conducted in split-split plot design with five intercropping systems [sole cowpea, sole baby corn, cowpea + baby corn (2:1), cowpea + baby corn (3:1) and cowpea+ baby corn (4:1)] in main plot, three fertility levels (100, 125 and 150% RDF) in sub plot and two stress mitigating chemicals (0.5% $CaCl_2$ and 1% KNO_3 at flowering and pod development stage of cowpea) in sub-sub plot with four replications. Cowpea (var. GC 4) and baby corn (var. G 5414) were selected for monocrops and intercrops in the experiments.

The soil of the experimental field was medium black clay loam in texture fairly deep having good drainage facilities. The mean annual maximum and minimum temperatures are 40.2°C and 18.5°C, respectively. The summer months are hot and May is the hottest month having a maximum temperature up to 43.5°C. The mean daily maximum and minimum temperature during the growing season fluctuated between 37.1 to 47.3°C and 17.1 to 33.6°C, respectively in the year 2019. The corresponding values for the year 2020 were between 37.0 to 44.5°C and 17.36 to 24.36°C, respectively. There was rainfall of 41.0 mm and 33.7 mm in the year 2019 and 2020, respectively. Summer season's total rainfall during both the years were uniform in amount and distribution were recorded. The simultaneous sowing of healthy and well matured bold seeds of cowpea as well baby corn was done in lines according to the specific row arrangements. In the sub plots three fertility levels 100%, 125% and 150% RDF were applied prior to sowing by broadcasting as per treatment through urea and SSP respectively.

Result and Discussion

Cowpea equivalent Yield

Pooled analysis of data (Table 1) showed that the significantly higher cowpea equivalent yield was recorded in cowpea and baby corn 2:1 row ratio fertilized with 150% RDF over rest of the treatment combinations. The higher cowpea equivalent yield might be due to higher economic yield of both component crops and efficient use of available resources under intercropping systems then sole cropping. The different behaviour in crop equivalent yield was also on account of productivity of crops in intercropping systems and their relative market prices. Ganvir *et al.* (2004) and Devi and Singh (2018) also reported the similar trend.

Economics

Interactive effect of intercropping and fertility levels was observed that highest gross return, net return and B:C ratio were obtained in 2:1 row ratio of cowpea + baby corn with 150% of recommended dose of nitrogen and phosphorus, significantly higher as compared to other treatment

Table 1. Interactive effect of intercropping systems and fertility levels on cowpea equivalent yield (kg/ha) (Pooled mean of two year)

Intercropping system	Fertility level (NP)		
	100% RDF	125% RDF	150% RDF
Sole cowpea	714	756	797
Sole baby corn	815	823	852
Cowpea + Baby corn (2:1)	883	971	1036
Cowpea + Baby corn (3:1)	805	897	953
Cowpea + Baby corn (4:1)	755	831	891
SEm±	16.11		
CD (P=0.05)	45.58		

Table 2. Interactive effect of intercropping systems and fertility levels on gross return (₹/ha) of summer cowpea intensified with baby corn (Pooled mean o two year)

Intercropping system	Fertility level (NP)		
	100% RDF	125% RDF	150% RDF
Sole cowpea	37908	40113	42279
Sole baby corn	56511	57364	59236
Cowpea + Baby corn (2:1)	54165	58956	62880
Cowpea + Baby corn (3:1)	48077	53240	56306
Cowpea + Baby corn (4:1)	43571	47797	51141
SEm±	803		
CD (P=0.05)	2271		

Table 3. Interactive effect of intercropping systems and fertility levels on net return (₹/ha) of summer cowpea intensified with baby corn (Pooled mean of two year)

Intercropping system	Fertility level (NP)		
	100% RDF	125% RDF	150% RDF
Sole cowpea	17642	19412	21141
Sole baby corn	25965	26383	27818
Cowpea + Baby corn (2:1)	26959	31315	34802
Cowpea + Baby corn (3:1)	22621	27349	29978
Cowpea + Baby corn (4:1)	19865	23656	26513
SEm±	803		
CD (P=0.05)	2271		

Table 4. Interactive effect of intercropping systems and fertility levels on B:C ratio of summer cowpea intensified with baby corn (Pooled mean of two year)

Intercropping system	Fertility levels (NP)		
	100% RDF	125% RDF	150% RDF
Sole cowpea	1.87	1.94	2.00
Sole baby corn	1.84	1.85	1.89
Cowpea + Baby corn (2:1)	1.99	2.13	2.24
Cowpea + Baby corn (3:1)	1.89	2.04	2.14
Cowpea + Baby corn (4:1)	1.84	1.98	2.08
SEm±	0.03		
CD (P=0.05)	0.09		

combination (Table 2 to 4). This result could be attributed to higher cowpea equivalent yield, market price and efficient utilization of resources such as light, water and nutrient than other combination consequently fetched higher economics return. The results are in agreement with those obtained by Osman *et al*., (2011) and Shoeib (2012).

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