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ASSESSMENT OF YIELD ADVANTAGES OF PIGEONPEA BASED CROPPING SYSTEM

RAJESHNALLAIAH AND B. J. PANDIAN

DEPARTMENT OF AGRONOMY,

TAMIL NADU AGRICULTURAL UNIVERSITY,

COIMBATORE-3, TAMIL NADU, INDIA.

Corresponding author's e-mail: rajesh_2050@rediffmail.com

ABSTRACT:

A field experiment was conducted at at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Telangana (India) during kharif 2014 and2015 to improved crop productivity through pigeonpea based cropping. The experiment was laid out in split split plot Design with 3 replications. Adjacent to the treatment plots, sole soybean was also raised in dummy plots with same management practices to calculate the yield advantages. The treatments comprised of method planting, cropping system and various genotypes (TS3R, Hybridr and Maruthi) showed positive effect on various agronomic traits. The transplanted hybrid pigeonpea with intercropped soybean recorded significantly higher LER (1.73 & 1.5) and ATER (1.4 &1.5) was recorded both years.

KEY WORD: *Transplanting pigeonpea, Intercropping, Genotypes, LER, ATER.*

INTRODUCTION:

Pigeonpea *(Cajanus cajan* L.) is one of the major grain legume crop of tropical and subtropical regions and it is grown predominantly under rainfed conditions. India accounts for 90% of world's pigeonpea growing area and 85% of world's production of pigeonpea. In India, it is grown in an area of 4.5 M ha with an annual production of 3.3 MT and productivity of 799 kg ha [1]. When pigeonpea is grown as a sole crop, it is relatively

inefficient because of its slow initial growth rate and low harvest index; therefore, it is grown as intercrop, which helps in efficient utilization of available resources for enhancing the productivity and profit. Pigeonpea is desirable for inter-cropping with different crops like cotton, sorghum, pearlmillet, greengram, blackgram, maize, soybean and groundnut for enhancing yield output and sustaining soil fertility. Soybean (*Glycine max* L.) is the most important rainy season oilseed crop grown on vertisols of the semi-arid tropical region of central India. Also one of the most essential pulse crop in India because of its shorter growth duration, low water demand, low soil fertility.

Agronomic package like plant population is recognized to affect crop environment, which determine the yield components. Optimum population levels should be maintained to tap utmost natural resources such as nutrient, sunlight, soil moisture and to assure satisfactory yield (Sharifi *et al.*, 2009). If plant population is lower than optimum, then per hectare production will be down and weeds will also be to a greater extent (Allard, 1999). The low productivity of pigeonpea has been ascribed to the reality that large area is under rainfed situation raised in broader spacing. Under such situation, other leguminous crops such as soybean can be sprung up as an intercrop to heighten the productivity of the system. However, intercropping in pigeonpea may not be potential with conventional planting direction sowing. Thereby adoption of transplanting pave a way for preserving the optimum plant population of pigeonpea and also it provides a chance for introducing an intercrop. Keeping above in perspective, a trial was carried out to study the effect of growing system, method planting under intercropped.

MATERIAL AND METHODS:

Climate and soil

Field experiment was conducted during *kharif*, 2014 & 15, to study the crop productivity of pigeonpea based cropping system at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Telangana (India) is situated at (17º32’ N latitude and 78º16’ E Longitude) and 545 m MSL. The mean annual rainfall of ICRISAT is 740 mm distributed over 37 rainy days and the mean maximum and minimum temperatures were 32 and 20°C, respectively during the crop period. The relative humidity ranged from 60 to 80% in the forenoon and 14 to 42% in the afternoon. The mean bright sunshine hours per day were 7.7 h. The meteorological data for the cropping season 2014 &15 was recorded at the ICRISAT agro-meteorological observatory during the cropping period of the experiments.

Treatment details

The treatments comprised of Method of planting (direct sowing & transplanting) , cropping

system (sole pigeonpea and pigeonpea intercrop with soybean and varieties (TS3R,Hybrid and Maruthi) were taken in split split plot with three replications. The gross and net plot sizes were 6x8.1 m and 5.5x7.65 m respectively. Adjacent to the treatment plots, sole soybean were also raised in dummy plots with same management practices to calculate the yield advantages. The JS335 of soybean was used as intercrop. Plants are harvested separately from the net plot area of each treatment and pods are separated, threshed, weighed and recorded as grain yield (kg ha^{-1}). The grain yield was recorded at 12% moisture level.

Assessment yield advantages

The yield differences among the treatments and sole plots were used to estimate the yield advantages. Yield advantages were calculated as proposed by Yoshida et al. (1972), Willey (1979) and Hiebsch and McCollum (1987).

Land equivalent ratio (LER)

$$LER = La+lb = Ya/Sa + Yb/Sb$$

Where, LA and LB are the LER for individual crops, YA and YB are the individual crop yield in intercropping, SA and SB are their sole crop yields.

Area time equivalent ration

$$ATER = \frac{(Ryc \times tc) + (Ryp \times tp)}{T}$$

RY = Relative yield of species C and P.

$$\frac{\text{Yield of intercrop per hectare}}{\text{Yield of monocrop per hectare}}$$

t = duration (days) for species C and P

T = duration (days) for the intercropped system.

RESULTS AND DISCUSSION:

Land equivalent ratio (LER)

The data obtained shows significant variations in land equivalent ratio due to cropping systems, crop growing system, method planting and cropping (table 1). Among the treatments, comparatively highest LER (1.73 &1.5) was recorded in irrigated transplanted pigeonpea. Rainfed sole pigeonpea + soybean recorded lower LER values (1.5 &1.3 during both years).

Area time equivalent ratio (ATER)

Area time equivalent ratio showed considerable variations due to cropping systems, irrigated transplanting pigeonpea and soybean . Among the intercropped treatments, irrigated trasplantig pigeonpea + soybean in different row ratios recorded significantly higher ATER (1.45 &1.5) than all other intercropping treatments Rainfed Pigeonpea + soybean recorded lower ATER (1.23 &1.3).

Land equivalent ratio (LER)

Advantage of intercropping over sole cropping system is measured through LER varied from 1.5 to 1.3 due to different planting method table(1). Thus, biological efficiency of land under intercropping was higher as compared to sole soybean /pigeonpea and method planting of pigeonpea intercropped with soybean. The higher LER under intercropping systems may be due to better planting and spatial arrangements which might have avoided the coincidence of the peak period of growth of component crops. Intercropping of pigeonpea and soybean in recorded higher yield LER of 1.73 &1.52 over other system and the lowest value of 1.5 &1.3. It was concluded at Jalgaon (Anon.,1988) revealed higher LER in sesame + pigeonpea intercropping system in 2:1 and 3:1 row proportion than sole crop. Similar such results were also reported by Subbareddy and Venkateshwarlu (1992), Singh and Singh (1994), Narkhede and Katare (1998), Srinivasulu (2002), wherein pigeonpea + sesame intercropping combination recorded maximum LER values over other intercrops with pigeonpea.

Area time equivalent ratio (ATER)

In the present investigation, ATER realized from intercropping systems of pigeonpea and soybean was notably higher than that obtained from either sole crop of pigeonpea or soybean. Higher ATER (1.15) under intercropping of transplanting pigeonpea and soybean under irrigated condition indicate that not only the efficient use of land, but efficient use of time. The extent of time utilization ranges 17 &15 per cent (table 1)Similar results were also reported by Pujari (1996) in pigeonpea + soybean (2:2) and Patil (2003) in little millet + pigeonpea (4:2) intercropping systems. . Thus, it can be inferred from the above results, on the basis of agronomic as well as economic performance, transplanting the pigeonpea + soybean intercropping proved to be more productive and remunerative and this salient finding will be useful for pigeonpea growers to enhance income under irrigated conditions of south India.

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Table1. Effect of method of planting and cropping system on Land Equivalent ratio, Area time equivalent ration on pigeonpea field at ICRISAT during 2014 and 2015

	2014		2015	
Treatment	**LER**	**ATER**	**LER**	**ATER**
M1C1V1	1.00	1.00	1.00	1.00
M1C1V2	1.00	1.00	1.00	1.00
M1C1V3	1.00	1.00	1.00	1.00
M1C2V1	1.50	1.29	1.2	1.1
M1C2V2	1.55	1.35	1.5	1.3
M1C2V3	1.37	1.22	1.4	1.2
M2C1V1	1.00	1.00	1.00	1.00
M2C1V2	1.00	1.00	1.00	1.00
M2C1V3	1.00	1.00	1.00	1.00
M2C2V1	1.48	1.23	1.45	1.3
M2C2V2	1.73	1.44	1.6	1.5
M2C2V3	1.60	1.33	1.5	1.4