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EFFECT OF VARYING LEVELS OF PLANT POPULATION AND NUTRIENT MANAGEMENT IN PIGEONPEA UNDER ZAI METHOD OF CULTIVATION

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Abstract

The field experiment was conducted at college of Agriculture farm, Bijapur during *kharif* season 2013-14 to study the performance of pigeonpea [*Cajanus cajan* (L.) Millsp.] under different plant population and nutrient levels in Zai method of cultivation under dry land situation. The different plant populations and nutrient levels were practiced under zai method of *insitu* moisture conservation method were compared with recommended practice. The result shows that 22 seeds per Zai + 125% RDF with plant population 91674 plants ha^{-1} produced significantly higher seed yield (2188 kg ha^{-1}) and net returns (Rs. 63427 ha^{-1}) compared to recommended practice. However, higher benefit cost ratio (4.52) was observed in recommended practice compared to zai method of treatments. Significantly higher pods per plant, pod weight per plant and seed yield per plant was recorded in the treatment receiving 10 seeds per zai + 125% RDF compared with other treatments.

Key words : Zai method, pigeonpea, seed yield, nutrient levels, dryland.

Introduction

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is a preferred crop in *kharif* season among the majority of farmers in Northern Dry Zone of Karnataka, India. The recommended *in-situ* moisture conservation practices for the zone *viz*. broad furrow and ridge, compartment bunding, tied ridging, contour cultivation, set furrow cultivation, hill method of planting, paired row planting, wider row planting and sara method mainly aim at uniform distribution of moisture in the soil profile controlling sheet or rill erosion, increasing the infiltration opportunity time, increasing rainfall use efficiency and adequate drainage thereby ensuring moisture availability for longer period of plant growth. However, the above listed *in-situ* moisture conservation practices require maintenance of bullock or mechanical power which becomes uneconomical and no feasible for the small and marginal farmers, which constitute a majority of the population in the area. Zai method seems to be the possible solution to the above constraints.

Zai is a traditional land rehabilitation technology "invented" by farmers in Burkina Faso. In Zai method of cultivation circular pits of 15-20 cm diameter are opened at an interval of 2 × 1 meter. Sowing or dibbling of seeds is done along the circumference of the pits. The Zais are filled with FYM or vermicompost or green leaf manures along with fertilizers. The seeds are sown such that recommended plant population per unit area is maintained. The pits ensure better interception and storage of rain water as well as runoff water thus supplying water to the crop for a longer period. Zai method of cultivation is also advantages in areas where availability of animal power is very meager. With this background, a study was undertaken to evaluate the effect of varying levels of plant population and nutrient management on the yield components, yield and economics of pigeonpea under Zai method of cultivation in dry land situation.

Materials and Methods

A field experiment was conducted at College of Agricultural Farm, Bijapur during *kharif* 2013-14 in *vertisols* under rainfed conditions. The soil of the experimental field was medium deep black (100-135 cm), clayey in texture (18.7% sand, 15.2% silt, 60.3% clay), pH 8.8, E.C 0.41, low in organic carbon (0.13%), medium in available nitrogen (204 kg ha^{-1}), low in available phosphorus (21.5 kg ha^{-1}) and low in available potassium

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(255.0 kg ha^{-1}). The treatments included four levels of plant population (22, 18, 14 and 10 seeds per Zai pit) and three levels of fertilizer application (25: 50: 0, 31.5: 62.5:0 and 37.5 : 75 : 0 kg N : P_2O_5 : K_2O ha^{-1}, respectively) under Zai method of cultivation which was compared with farmers' practice. Thirteen treatments were tested in randomized complete block design with three replications in a plot size 12 × 9.6 m^2. Circular pits having diameter 60 cm and depth about 15cm were dug in straight lines 2 m apart. The intra row distance was kept at 1.2m. Seeds were dibbled along the periphery of the pit on the 2nd forth night of May. FYM (6 t/ha) and *Glyricidia* (5 t/ ha) were applied in all the pits. The data on yield attributes, yield and economics were recorded using standard procedures.

Results and Discussion

Among the treatments 22 seeds + 125% RDF (91674 plants ha^{-1}) (2188 kg/ha) recorded significantly higher seed yield compared to the recommended practice (flatbed 90 cm × 20 cm with RDF) (55556 plants ha^{-1}) (1626 kg/ha). 22 seeds + 125% RDF (91674 plants ha^{-1}) (2188 kg/ha) being on par with 22 seeds per zai + 150% RDF (91674 plants ha^{-1}) (2094 kg/ha), 22 seeds per zai + 100% RDF (91674 plants ha^{-1}) (2072 kg/ha) and 18 seeds per zai + 125% RDF (75006 plants ha^{-1}) (2025 kg/ha). The tune of 34.40, 28.62, 27.27 and 24.38 per cent respectively (table 3). 22 seeds + 125% RDF (91674 plants ha^{-1}) also recorded higher stalk yield ha^{-1} (6529 kg ha^{-1}) and harvest index (25.10 per cent) compared to recommended practice. The superiority of treatments under Zai method over recommended practice may be attributed to better soil moisture conservation at different stages of pigeonpea, optimum plant population and adequate nutrient management compared to recommended practice resulting in higher number of pods per plant, pod weight per plant and seed yield per plant. (table 1). These results are in conformity with the findings of Anonymous (2003), Muthamilselvan *et al*. (2006), Mula *et al.* (2010).

Among the yield components, 10 Seeds per zai + 125% RDF (41670 plants ha^{-1}) recorded maximum number of pods per plant (172 $plant^{-1}$), pod weight per plant (92.81 g), seed per pod (4.33 pod^{-1}) and seed yield per plant (74.59 g) compared to recommended practice (flatbed 90 cm x 20 cm with RDF) (55556 plants ha^{-1}) (115 pods $plant^{-1}$) (table 1). The higher number of pods, pod weight and seed yield per plant were higher in lesser number of plants per zai, which may be attributed to reduce the competition for limited resources (water, nutrients, light etc.) resulting in increase in the number of primary branches and other yield parameters. Similar results reported by Mula *et al.* (2010).

The gross returns (Rs. 91902 ha^{-1}) and net returns (Rs. 63427 ha^{-1}) were significantly higher in 22 seeds per zai + 125% RDF (91674 plants ha^{-1}) compared to recommended practice (flatbed 90 cm × 20 cm with RDF) (55556 plants ha^{-1}) (Rs. 68296 ha^{-1}), which was directly correlated to seed yield per hectare (table 4). However, the benefit cost ratio (4.52) was significantly higher in the recommended practice (flatbed 90 cm × 20 cm with RDF) (55556 plants ha^{-1}) compared zai method of

Table 1 : Yield and yield components of pigeonpea as influenced by planting geometry and fertility levels under Zai cultivation.

Tr. No.	Treatments	Pods per plant	Seeds per pod	Pod weight $plant^{-1}$ (g)	Seed yield $plant^{-1}$ (g)	100 seed weight (gm)
T_1	22 seeds per zai +100% RDF (91674 plants ha^{-1})	128	3.33	69.21	60.35	12.30
T_2	22 seeds per zai +125% RDF (91674 plants ha^{-1})	144	3.67	75.13	70.26	13.35
T_3	22 seeds per zai +150% RDF (91674 plants ha^{-1})	137	3.33	68.85	65.01	12.01
T_4	18 seeds per zai +100% RDF (75006 plants ha^{-1})	127	3.67	68.58	60.17	12.34
T_5	18 seeds per zai +125% RDF (75006 plants ha^{-1})	145	4.00	69.53	69.96	12.18
T_6	18 seeds per zai +150% RDF (75006 plants ha^{-1})	133	3.67	67.27	64.04	11.59
T_7	14 seeds per zai +100% RDF (58338 plants ha^{-1})	143	3.00	74.41	60.09	10.88
T_8	14 seeds per zai +125% RDF (58338 plants ha^{-1})	151	3.33	80.11	68.96	12.85
T_9	14 seeds per zai +150% RDF (58338 plants ha^{-1})	150	4.00	76.48	65.45	12.87
T_{10}	10 Seeds per zai + 100% RDF (41670 plants ha^{-1})	164	3.33	87.61	65.35	11.96
T_{11}	10 Seeds per zai +125% RDF(41670 plants ha^{-1})	172	4.33	92.81	74.59	11.83
T_{12}	10 Seeds per zai +150% RDF (41670 plants ha^{-1})	162	3.00	89.27	66.33	11.83
T_{13}	Flat bed 90 cm x 20 cm with RDF(55556 plants ha^{-1})	115	3.33	57.23	51.32	12.45
S.Em±		3.44	0.39	2.52	2.37	0.44
C.D.at 5%		10.04	NS	7.35	6.91	NS

Table 2 : Seed yield, stalk yield and harvest index of pigeonpea as influenced by planting geometry and fertility levels under Zai cultivation.

Tr. No.	Treatments	Seed yield (kg ha^{-1})	Stalk yield (kg/ha)	Harvest index (%)
T_1	22 seeds per zai +100% RDF (91674 plants ha^{-1})	2072	6251	24.90
T_2	22 seeds per zai +125% RDF (91674 plants ha^{-1})	2188	6529	25.10
T_3	22 seeds per zai +150% RDF (91674 plants ha^{-1})	2094	6451	24.50
T_4	18 seeds per zai +100% RDF (75006 plants ha^{-1})	1970	6142	24.27
T_5	18 seeds per zai +125% RDF (75006 plants ha^{-1})	2025	6178	24.68
T_6	18 seeds per zai +150% RDF (75006 plants ha^{-1})	1985	6027	24.78
T_7	14 seeds per zai +100% RDF (58338 plants ha^{-1})	1754	5401	24.53
T_8	14 seeds per zai +125% RDF (58338 plants ha^{-1})	1846	5620	24.73
T_9	14 seeds per zai +150% RDF (58338 plants ha^{-1})	1812	5466	24.90
T_{10}	10 Seeds per zai + 100% RDF(41670 plants ha^{-1})	1730	5436	24.15
T_{11}	10 Seeds per zai +125% RDF(41670 plants ha^{-1})	1778	5447	24.58
T_{12}	10 Seeds per zai +150% RDF (41670 plants ha^{-1})	1760	5406	24.55
T_{13}	Recommended practice (flat bed 90 cm × 20 cm with RDF) (55556 plants ha^{-1})	1626	5500	22.81
S.Em±		56.66	157.92	0.31
C.D.at 5%		165.37	460.95	0.91

Table 3 : Economics of pigeonpea of the soil in experimental plot as influenced by planting geometry and fertility levels under Zai cultivation.

Tr. No.	Treatments	Gross returns (Rs/ha^{-1})	Net returns (Rs/ha^{-1})	B:C
T_1	22 seeds per zai +100% RDF (91674 plants ha^{-1})	87024	59078	3.11
T_2	22 seeds per zai +125% RDF (91674 plants ha^{-1})	91902	63427	3.23
T_3	22 seeds per zai +150% RDF (91674 plants ha^{-1})	87947	58942	3.03
T_4	18 seeds per zai +100% RDF (75006 plants ha^{-1})	82746	54974	2.98
T_5	18 seeds per zai +125% RDF (75006 plants ha^{-1})	85034	56733	3.00
T_6	18 seeds per zai +150% RDF (75006 plants ha^{-1})	83372	54540	2.89
T_7	14 seeds per zai +100% RDF (58338 plants ha^{-1})	73656	45970	2.66
T_8	14 seeds per zai +125% RDF (58338 plants ha^{-1})	77515	49300	2.75
T_9	14 seeds per zai +150% RDF (58338 plants ha^{-1})	76115	47370	2.65
T_{10}	10 Seeds per zai + 100% RDF(41670 plants ha^{-1})	72676	45077	2.63
T_{11}	10 Seeds per zai +125% RDF(41670 plants ha^{-1})	74686	46558	2.66
T_{12}	10 Seeds per zai +150% RDF (41670 plants ha^{-1})	73910	45252	2.58
T_{13}	Recommended practice (flat bed 90 cm x 20 cm with RDF) (55556 plants ha^{-1})	68296	53181	4.52
S.Em±		2380	2380	0.09
C.D.at 5%		6946	6946	0.26

cultivation, which was due to the higher cost of cultivation in zai treatments compared to recommended practice (flatbed 90 cm × 20 cm with RDF) (55556 plants ha^{-1}). Similar results reported by Hulihalli (2003) and Arjun Sharma *et al*. (2004).

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