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RESEARCH PAPER

Economic analysis of seed production in transplanted pigeonpea [*Cajanus cajan* (L.) Millsp.]

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ABSTRACT

A field experiment was conducted at MARS, Dharwad to evaluate the effect of different age of seedlings and inter row spacing on plant growth, seed yield and economic parameters in transplanted pigeonpea seed production. The seedlings transplanted at 120 cm inter row spacing produced significantly more seed yield (22.46 q/ha), gross returns (Rs.88,760.00), net returns (Rs.72,007.59) and cost benefit ratio (5:28).The 28 days old seedlingd transplanted to main field produced significantly higher plant height (215.67), primary branches (25.49), secondary branches (30.98), thick stem (2.83 cm), number of pods per plant (300.00), seed yield per plant (269.33 g), seed yield (23.62 q/ha),gross returns (Rs.92,880.00), net returns (Rs.76,116.39) and cost benefit ratio (5:53). Treatment combination of 28 days old seedlings transplanted at 120 cm inter row spacing was found significantly superior with respect to seed yield (24.33 q/ha), gross returns (Rs.97,320.00), net returns (Rs. 80,565.34) and cost benefit ratio (5.80).

KEY WORDS : Economic analysis, Pigeonpea transplanting, Row spacing, Seedling age

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Pigeonpea (red gram) is an important pulse crop in India. It is also known as, Arhar and Tur. Red gram is mainly cultivated and consumed in developing countries of the world. This crop is widely grown in India. India is the largest producer and consumer of red gram in the world. Red gram is a protein rich staple food. It contains about 22 per cent protein. It supplies a major share of protein requirement of vegetarian population of the country. In addition to being an important source of human food and animal feed, red gram also plays an important role in sustaining soil fertility by improving physical properties of soil and fixing atmospheric nitrogen. India alone accounted for about 89 per cent of total world's production and 90 per cent of total world's consumption of red gram. The yield of pigeonpea is greatly influenced by a number of agronomic practices but timely sowing of seeds with onset of monsoon is most important aspect which decides the final seed yield. In order to ensure timely sowing due to late onset of monsoon, transplanting of pigeonpea seedlings will be one of the techniques to overcome delayed sowing and also increase the average yield. With this background an experiment was conducted at the Main Agricultural Research Station, Dharwad during the *Kharif* season.

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METHODOLOGY

Experiment was laid out in spit plot design with three replications, main plot consisted of three row spacing (M_1- 90 cm, M_2 -120 cm and M_3- 150 cm) and sub plot consisted transplanting of different aged seedlings (S_1- 21 days old seedlings, S_2- 28 days old seedlings, S_3- 35 days old seedlings and S_4- direct soil dibbled). Seedlings of *cv*-BSMR-736 were

raised by using a polythene bag of 6 x 4 cm size, filled with sand, soil and vermicompost in 1:1:1 ratio. The seeds were dibbled in polythene bags in three different dates such that at the end of 35 days, three batches of different aged seedlings were ready for transplanting in the field on the first week of June.

The seedlings were transplanted to the main field with onset of monsoon according to treatments and inter row spacings were maintained along with control (direct soil dibbling), one healthy seedlings per hill was maintained by thinning after seedlings establishment, plant protection measure undertaken as for package of practice. Plant growth and seed yield parameters were recorded at the time of harvest. Net returns, gross returns and cost benefit ratio were calculated based on the redgram price prevailing in the market.

ANALYSIS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Plant growth parameters:

The effect of inter row spacing and age of seedling on plant growth parameters are presented in Table 1. Pigeonpea seedling transplanted at 90 cm inter row spacing recorded significantly highest plant height (202.00 cm) as compared to wider row spacing but produced less number of branches, this might be due to the competition among the seedlings for nutrients and solar energy when transplanted at narrow row spacing. Whereas the seedlings transplanted at wider row spacing of 150 cm produced significantly more number of primary branches (24.74), secondary branches (28.42) and thickest stems (2.97 cm) due to the wider spacing might have resulted in profuse branching compared to closer row spacing. Transplanting of 28 days old seedling resulted in increase plant height (215.67 cm), primary branches (25.49), secondary branches (30.98) and stem girth (2.83 cm). This may be attributed to the 28 days old seedlings have capacity to withstand transplanting shock and require less time for establishment as compared to too young or aged seedlings to slow growth. Significantly best treatment combination was of 28 days old seedling transplanted at inter row spacing of 150 cm with respect to number of primary branches (29.47), secondary branches (38.00) and stem girth (3.37 cm) this might be due to the additive effect of two factors. The results are in parallel with finding of Reddy and Reddy (1992).

Seed yield parameters:

Effect of inter row spacing and age of seedlings on seed yield parameters are presented in Table 2. Number of pods per plant (297.25) and seed yield per plant (266.17 g)

Table 1: Effect of inter row spacing and age of seedling on plant growth parameters

Treatments	Plant height (cm)	Primary branches	Secondary branches	Stem diameter
Main plot				
M_1	202.00	21.00	23.06	2.22
M_2	190.58	22.87	23.95	2.58
M_3	180.42	24.74	28.42	2.97
S.E. ±	3.90	0.68	1.20	0.09
C.D. at 5 %	12.13	2.01	3.60	0.27
Subplot				
S_1	181.67	22.28	23.16	2.29
S_2	215.67	25.49	30.98	2.83
S_3	213.11	22.22	25.46	2.81
S_4	153.56	21.49	20.98	2.16
S.E. ±	13.20	0.72	0.61	0.07
C.D. at 5 %	33.93	2.13	2.00	0.22
Interaction				
M_1S_1	186.00	22.00	20.47	2.03
M_1S_2	230.00	22.00	26.47	3.06
M_1S_3	221.00	19.33	23.70	2.27
M_1S_4	162.00	20.67	21.60	2.00
M_2S_1	181.00	22.33	24.00	2.53
M_2S_2	218.00	25.00	28.47	3.01
M_2S_3	211.00	22.33	25.00	2.86
M_2S_4	152.33	21.80	18.33	1.92
M_3S_1	178.00	22.50	25.00	2.78
M_3S_2	199.00	29.47	38.00	3.37
M_3S_3	198.33	25.00	27.67	3.16
M_3S_4	146.33	22.00	23.00	2.55
S.E. ±	21.24	1.87	0.91	0.09
C.D. at 5 %	65.13	5.89	2.72	0.27

M_1 = Inter row spacing of 90 cm , S_1= 21 days old seedling
M_2 =Inter row spacing of 120 cm, S_2 = 28 days old seedling
M_3= Inter row spacing of 150 cm, S_3 = 35 days old seedling
S_4 = Normal sowing, NS= Non-significant

significantly increased due to the wider row spacing of 150 cm, this might be due to the increased plant growth parameters which have positive correlation with seed yield and its attributes. Seed yield (22.46 q/ha) was significantly increased at row spacing of 120 cm, this might be due to the more number of plants (27 777), even though the yield attributes were significantly lower when compared to the yield attributes recorded under wider row spacing (150 cm), that might be due to the reason that seedlings transplanted in wider row spacing have grown luxuriously by utilizing sufficient light, moisture and soil nutrients but beneficial effect of wider spacing on individual plant growth could not augment the seed yield per ha because of lower plant population. Whereas in closer inter row (90 cm) spacing, there were sufficient number of plants per unit area but those plants have to compete among each other for basic input and

resulted in the lower yield, the seedlings transplanted in optimum inter row spacing (120 cm) had the advantage of both wider spacing and large population. These results are in accordance with the findings of Shaik Mohammed (1997) and Parameshwari *et al.* (2003).

The significantly higher number of pods per plant (300.00), seed yield per plant (269.33 g), seed yield (23. 62 q/ha) and reduced plant damage (12.06 dead plants/ plot) recorded when 28 days old seedlings were transplanted to filed as compared to 21, 35 days old seedlings and control. This increase in yield parameters from 28 days old seedlings transplanted in the field might be due to proper establishment and increased plant growth parameters, which was not observed either in 35 days aged seedling nor 21 days too young seedling. Significantly complimentary additive interaction recorded with 28 days old seedlings transplanted in 120 cm inter row spacing with respect to seed yield (24.33 q/ha) and reduced plant damage (11.40 dead plants per plot).

Table 2: Effect of inter row spacing and age of seedling on seed yield parameters

Treatments	Number of pods per plant	Seed yield per plant (g)	Seed yield (q / ha)	Dead plants per plot
Main plot				
M_1	254.00	223.58	19.08	12.37
M_2	275.58	245.58	22.46	12.34
M_3	297.25	266.17	21.83	12.31
S.E.±	16.13	15.64	0.63	0.14
C.D. at 5 %	44.78	43.42	1.86	N S
Sub plot				
S_1	267.11	237.67	20.44	14.49
S_2	300.00	269.33	23.62	12.06
S_3	287.44	261.22	22.38	13.01
S_4	237.89	207.22	17.33	23.26
S.E.±	13.12	13.20	0.43	1.11
C.D. at 5 %	33.76	33.96	1.30	1.34
Interaction				
M_1S_1	238.00	208.00	17.00	15.53
M_1S_2	282.00	252.00	22.33	11.70
M_1S_3	282.00	250.33	19.67	13.83
M_1S_4	214.00	184.00	16.33	33.40
M_2S_1	266.00	236.00	22.33	15.50
M_2S_2	296.00	273.00	24.33	11.40
M_2S_3	300.00	266.00	23.10	12.30
M_2S_4	227.33	207.33	19.00	21.17
M_3S_1	297.33	269.00	22.00	14.50
M_3S_2	315.00	283.00	23.00	10.90
M_3S_3	304.32	262.33	22.17	11.89
M_3S_4	262.31	203.33	16.67	19.17
S.E.±	12.11	16.53	2.01	2.10
C.D. at 5 %	24.45	50.17	6.55	6.37

M_1 = Inter row spacing of 90 cm, S_1= 21 days old seedling
M_2 =Inter row spacing of 120 cm, S_2 = 28 days old seedling
M_3= Inter row spacing of 150 cm, S_3 = 35 days old seedling
S_4 = Normal sowing, NS= Non-significant

Economic parameters:

Effect of inter row spacing and age of seedlings on economic parameters are presented in Table 3. Significantly

Table 3 : Effect of inter row spacing and age of seedling on economic parameters

Treatments	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs. /ha)	Cost benefit ratio
Main plot				
M_1	16,414.90	75,330.00	58,521.65	4.48
M_2	16,001.66	88,760.00	72,007.59	5.28
M_3	15,309.56	84,340.00	67,612.38	5.04
S.E.±	250.00	650.00	1203.00	0.15
C.D. at 5 %	803.00	2015.00	3611.00	0.47
Sub plot				
S_1	16,763.61	81,773.33	65,009.72	4.88
S_2	16,763.61	92,880.00	76,116.39	5.53
S_3	16,763.61	87,253.33	70,489.02	5.20
S_4	13,270.66	63,333.33	50,067.67	4.52
S.E.±	315.00	902.00	893.00	0.01
C.D. at 5 %	1030.00	2810.00	2670.00	0.27
Interaction				
M_1S_1	16,808.35	68,000.00	51191.65	4.04
M_1S_2	16,301.35	89,320.00	72511.65	5.31
M_1S_3	16,100.35	78,680.00	61871.65	4.68
M_1S_4	13,808.35	63,320.00	48511.65	3.88
M_2S_1	16,754.66	89,320.00	72565.34	5.33
M_2S_2	16,251.66	97,320.00	80565.34	5.80
M_2S_3	16,010.66	92,400.00	75654.34	5.50
M_2S_4	13,631.00	68,000.00	59245.34	4.50
M_3S_1	16,727.82	88,000.00	71272.58	5.26
M_3S_2	16,421.82	92,000.00	75272.58	5.49
M_3S_3	16,032.82	90,680.00	73952.18	5.42
M_3S_4	12,121.00	59,680.00	49952.18	3.98
S.E.±	1312.00	1790.00	1590.00	0.03
C.D. at 5 %	4012.00	5513.00	5019.00	1.01

M_1 = Inter row spacing of 90 cm, S_1= 21 days old seedling
M_2 =Inter row spacing of 120 cm, S_2 = 28 days old seedling
M_3= Inter row spacing of 150 cm, S_3 = 35 days old seedling
S_4 = Normal sowing, NS= Non significant

higher gross (Rs. 88, 760/-) and net returns (Rs. 72, 007/-) and cost benefit ratio (5.28) had recorded with 120 cm inter row spacing. Twenty eight days old seedlings transplanted to main field recorded significantly highest gross returns (Rs. 92, 880/-), net returns (Rs. 76,116/-) and cost benefit ratio (5:53). Similar results were recorded by Antaravalli *et al*. (2002 a and b). The interaction was also found significant when treatment combination of 28 days old seedlings were transplanted with 120 cm inter row spacing which produced highest gross returns (Rs.97,320/-), net returns (Rs. 80, 565/-) and cost benefit ratio (5.80). This significant increment in economic parameters are due to the high seed yield per unit and area and also higher market price that is results of transplanting, because transplanted seedlings are well in advanced stage of development and they switch over to early reproductive phage as compared to the normal sown plants and also early harvest produce fetches good market price because of less supply and high demand. These results are on par with findings of Ravikumar (2007) and Pramod (2007) in pigeonpea crop.

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