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Effect of Time of Sowing, Spacing and Seed Rate on Seed production Potential and Economics of Fodder Cowpea Under Rainfed Condition

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ABSTRACT

A Field experiment was conducted during *kharif* 2005 on medium deep black clay soil under rainfed condition at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, to study the effect of time of sowing, spacing and seed rate on seed production potentiality of fodder cowpea. Sowing in June 2nd fortnight recorded significantly higher seed yield (925 kg ha^{-1}), haulm yield (4442 kg ha^{-1}) and harvest index (0.20) compared to July 1st fortnight (675 kg ha^{-1}, 4028 kg ha^{-1} and 0.16, respectively) and July 2nd fornight (519 kg ha^{-1}, 3701 kg ha^{-1} and 0.16, respectively) sowing. The row spacing of 30 cm recorded significantly favourable growth and yield attributes, seed yield (743 kg ha^{-1}) and haulm yield (4198 kg ha^{-1}) compared to 45 cm. Seed rate had no significant influence on growth and yield of fodder cowpea. The combination of June 2nd fortnight sowing with 30 cm row spacing at 30 kg ha^{-1} seed rate recorded higher seed yield (1056 kg ha^{-1}), haulm yield 94970 kg ha^{-1}) and significantly higher net income (Rs. 28282 ha^{-1}) and benefit cost ratio (4.71).

Key words : Fodder cowpea,Seed rate, Seed yield, Sowing time, Spacing.

Seed is the most important input in the fodder crop production programmes; since most of the fodder crops are harvested for green fodder at flowering stage or before seed maturity, their seed production assumes greater importance. Seed rate in forage crops is high but the seed multiplication ratio is low compared to grain crops and as the forage crops are basically bred for higher biomass production, there is large gap in the seed production and requirement. Any programme for fodder crop production should be ensured to provide seeds of improved varieties to the farmers at the proper time, place and prices, failing which the farmers are unlikely to take up fodder production in a big way and will continue with their traditional systems. At present, all the recognized agencies together produce around 20,000 metric tonnes of fodder seeds annually against the estimated requirement 1,00,000 metric tonnes of improved fodder seeds of cultivated crops (Singh, 2003). Leguminous fodder crops are known for their quality and yield. Among the leguminous fodder crops, cowpea (*Vigna unguiculata* (L.) Walp) is one of the important vegetable cum pulse crop. As a forage crop, it is quick growing, high yielding, with substantially rich biomass production, grows well with associated crops and is highly proteinaceous. It is mainly grown as mixed/ intercrop with cereals for fodder production. However, qualityseed production and availability is lacking in forage legumes. In Northern parts of Karnataka, cowpea is one of the important kharif forage legumes. The cultivation package available for its seed production especially with respect to time of sowing, spacing and seed rate is lacking. Keeping this background in view, the present investigation was carried out.

MATERIAL AND METHODS

The field experiment was conducted at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad under rainfed conditions during *kharif* season of 2005. The rainfall received during the crop season was 938 mm. The soil of the experimental site was medium deep black clay. The soil was having medium available nitrogen, (305 kg ha^{-1}), available phosphorus (23.87 kg ha^{-1}) and available potassium (210.45 kg ha^{-1}). The experiment comprised of 18 treatment combinations, consisting of three times of swoing (June 2nd fortnight (22nd June), July 1st fortnight (15th July) and July 2nd fortnight (23rd July)) as main plots, two row spacings (30 cm and 45 cm) as sub plots and three seed rates (20,25, and 30 kg ha^{-1}) as sub-sub plots. The experiment was laid in split-split plot design with three replications. The entire quantity of recommended dose of fertilizers i.e. 25:50:50 kg NPK ha^{-1} was applied as abasal dose. Recommended cultural operations were attended to keep the plots weed free. The observations on plant height, number of leaves, LAI, total dry matter

production, number of pods per plant, number of seeds per pod, 1000 seed weight, seed yield per plant, seed yield per ha, haulm yield per ha and harvest index were recorded.

RESULTS AND DISCUSSION

Effect of time sowing

June 2nd fortnight sowing produced significantly higher seed yield (925 kg ha^{-1}) compared to July 1st fortnight (675 kg ha^{-1}) and July 2nd fortnight sowing (579 kg ha^{-1}). However, July 1st fortnight was significantly superior to July 2nd fortnight (Table1). June 2nd fortnight sowing produced 27 and 43 per cent higher seed yield compared to July 1st fortnight and July 2nd fortnight sowing, respectively. The haulm yield and harvest index were also significantly higher in June 2nd fortnight (4442 kg ha^{-1} and 0.20, respectively) compared to July 1st fortnight. The higher seed and haulm yield in June 2nd fortnight was mainly due to superior performance of all the growth and yield components. These results are in conformity with the findings of Ravinder and Singh (1998) and Yadav (2003). The significant increase in seed and haulm yield in June 2nd fortnight sowing can be attributed to the superior performance of all the growth and yield parameters (Table 1) viz., plant height (155.7 cm), number of leaves (38.3 $plant^{-1}$), LAI (2.09), total dry matter accumulation (65.22 g $plant^{-1}$) number of pods (11.9 $plant^{-1}$), number of seeds (11.9 pod^{-1}), 1000 seed weight (101.9 g) and seed yield (14.40 g $plant^{-1}$). These results are in agreement with the findings of Kurmawanshi *et.al.* (1994) Ravinder and Singh (1998) and Yadav (2003).

The significantly higher number of leaves and LAI in early sowing might have increased the photosynthetic area and activty of the crop leading to better performance of growth and yield components contributing to more seed yield. Similar results were obtained by Sreelatha *et al.* (1997) and Begum et al. (2003) in early sowing.

Effect of row spacing

The closer row spacing of 30 cm produced significantly higher seed yield (743 kg ha^{-1}) and haulm yield (4198 kg ha^{-1}), which was 10 per cent and 6 per cent higher, respectively compared to wider row spacing of 45 cm.

Higher seed and haulm yield in 30 cm row spacing can be related to siginificantly higher plant height (149.1 cm), number of leaves (34.3 $plant^{-1}$), LAI (2.01), total dry matter accumulation (60.40 g $plan^{t-1}$), number of pods (9.9 plant-1) and seed yield (10.14 g $plant^{-1}$), compared to that of 45 cm row spacing as the net photosynthesis is dependent on number of leaves and LAI. The higher amount of photosynthesis might have been produced and attributed for higher seed yield in closer row (30 cm) spacing. The similar results were also noticed by Arora *et al.* (1971), Angne *et al.* (1993) and Yadav (2003).

Effect of seed rate

The effect of seed rates on seed and haulm yield was not significant. This was due to on a par performance of the growth and yield parameters.

Economics

Sowing in June 2nd fortnight with 30 cm row spacing at 30, 25 and 20 kg ha^{-1} seed rate and at 45 cm row spacing with 25 kg ha^{-1} seed rate were significantly higher and on a par with respect to net income (Rs. 2828 ha^{-1}, Rs. 27122 ha^{-1}, Rs. 24632 ha^{-1} and Rs. 23262 ha^{-1}, respectively) and benefit cost ratio (4.71, 4.63, 4.36 and 4.16, respectively). This was mainly due to the higher seed and haulm yield compared to rest of the treatment combinations.

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Table 1. Growth, yield components and seed yield of fodder cowpea as influenced by time of sowing, spacing and seed rate

Treatments	Plant height (cm)	No.of leaves plant^{-1}	Leaf area index	Total dry matter production (g plant^{-1})	No.of pods plant^{-1}	No.of seeds pod^{-1}	1000 seed weight (g)	Seed yield (g plant^{-1})	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest index
Time of sowing											
June II fortnight	155.7	38.33	2.09	65.22	11.9	11.9	101.9	14.40	925	4442	0.20
July I fortnight	140.9	30.88	1.76	55.09	9.2	10.2	98.8	8.51	675	4028	0.16
July II fortnight	139.0	30.72	1.62	53.32	7.6	10.1	98.4	6.12	519	3701	0.14
S Em±	1.71	1.48	0.03	1.40	0.24	0.34	0.36	0.40	18.56	35.5	0.004
CD (0.05)	6.71	5.83	0.12	5.51	0.96	1.34	1.4	1.59	72.89	296.8	0.015
Row spacing											
30 cm	149.1	34.33	2.01	60.40	9.9	10.7	99.9	10.14	743	4198	0.17
45 cm	141.2	32.30	1.63	55.35	9.2	10.7	99.6	9.24	670	3916	0.17
S Em±	2.25	0.54	0.05	0.94	0.20	0.13	0.35	0.17	18.93	80.1	0.002
CD (0.05)	7.78	1.87	0.17	3.28	0.70	NS	NS	0.61	65.52	277.5	NS
Seed rate											
20 kg ha^{-1}	145.3	33.45	1.54	60.43	9.5	10.8	99.4	10.08	673	4120	0.16
25 kg ha^{-1}	147.0	33.67	1.82	57.87	9.5	10.5	99.6	9.33	741	4110	0.17
30 kg ha^{-1}	143.2	32.82	2.11	55.32	9.7	10.9	100.1	9.62	706	3941	0.17
S Em±	3.18	1.03	0.08	1.43	0.26	0.30	0.36	0.37	28.19	161.1	0.005
CD (0.05)	NS	NS	0.23	NS	NS	NS	NS	NS	NS	NS	NS

Interaction effects were non significant

NS : Non Significant

Table 2 . Gross income, cost of cultivation, net income and benefit cost (B: C) ratio of cowpea as influenced by time of sowing, spacing and seed rate.

Tr. No.	Treatments	Gross income (Rs.ha^{-1})	Cost of cultivation (Rs.ha^{-1})	Net income (Rs.ha^{-1})	B:C ratio
1.	$D_1S_1P_1$	31957	7325	24632	4.36
2.	$D_1S_1P_2$	34597	7475	27122	4.63
3.	$D_1S_1P_3$	35907	7625	28282	4.71
4.	$D_1S_2P_1$	27872	7325	20747	3.80
5.	$D_1S_2P_2$	31101	7475	23262	4.16
6.	$D_1S_2P_3$	27879	7625	20254	3.65
7.	$D_2S_1P_1$	23571	7325	16246	3.21
8.	$D_2S_1P_2$	23905	7475	16430	3.19
9.	$D_2S_1P_3$	26323	7625	18698	3.45
10.	$D_2S_2P_1$	20911	7325	13586	2.85
11.	$D_2S_2P_2$	26144	7475	18669	3.49
12.	$D_2S_2P_3$	21299	7625	13674	2.79
13.	$D_3S_1P_1$	18083	7325	10758	2.46
14.	$D_3S_1P_2$	20727	7475	13252	2.77
15.	$D_3S_1P_3$	17807	7625	10182	2.33
16.	$D_3S_2P_1$	19913	7325	12588	2.71
17.	$D_3S_2P_2$	17967	7475	10492	2.40
18.	$D_3S_2P_3$	17964	7625	10339	2.35
	S.Em±	2177.07	-	2168.64	0.29
	CD (0.05)	6257	-	6233	0.83

Time of sowing
D_1 - June 2nd fortnight
D_2 - July 1st fortnight
D_3 - July 2nd fortnight

Row spacing
S1 - 30 cm
S2 - 45 cm

Seed rate
P_1 - 20 kg ha^{-1}
P_2 - 25 kg ha^{-1}
P_3 - 30 kg ha^{-1}

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