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PERFORMANCE OF DIFFERENT MUNGBEAN VARIETIES ON PRODUCTIVITY POTENTIAL AND NODULATION PATTERN IN *VERTISOLS* OF CHHATTISGARH PLAINS

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ABSTRACT

The present investigation entitled "Performance of different mungbean varieties on productivity potential and nodulation pattern in Vertisols of Chhattisgarh plains" was carried out at Instructional Farm, IGAU, Raipur during kharif season of 2004. The soil of the experimental field was clayey in texture (Vertisols) locally known as "Bharri". The soil was neutral in pH and had low nitrogen and medium phosphorus and high in potassium content. The experiment was laid out in split plot design with three replications. The treatments consisted of four dates of sowing viz. 10th July (D_1), 25th July (D_2), 09 August (D_3) and 24th August (D_4) as main-plot treatment and twelve varieties viz., V_1 : TM-99-2, V_2 : Malviya Jyoti, V_3 : ML-5, V_4 : RM-03-71, V_5 : Pragya, V_6 : RM-06-08, V_7 : BM-4, V_8 : TM-2002-4, V_9 : ML-131, V_{10} : Pusa Vishal, V_{11} : TM-2000-1 and V_{12} : HUM-12 as sub-plot treatment..

Results revealed that growth parameters viz. number and dry weight of nodules and yield attributes were the highest under earliest date of sowing i.e. 10th July which ultimately gave the highest yield. Though, a slight reduction in yield was observed till 25th July sowing but drastic reduction in yield occurred if the sowing is delayed further.

Variety BM-4 was found to be best yielder (472 kg ha^{-1}) closely followed by HUM-12 (469 kg ha^{-1}). The economic returns from these varieties were also higher than others. Though, they had a lower test weight than Pragya, Malviya Jyoti and ML-5. Their more number of nodulation and dry weight have attributed for their supremacy over other varieties. Interaction between variety BM-4 and 10th July sowing outyielded amongst the other treatment combinations.

KEYWORDS: Fertilizer Contents, Mungbean Varieties and Nodulation Pattern

INTRODUCTION

In agriculture point of view, Chhattisgarh state is divided into three sub agroclimatic region, i.e. Chhattisgarh plains, Bastar plateau and Northern hill zone with four type of soils, *Bhata* (*Entisols*), *Matasi* (*Inceptisols*) 45.5 per cent, *Dorsa* (*Alfisols*) 10.0 per cent and *Kanhar* (*Vertisols*) 25.0 per cent of the total net cultivated area. In Chhattisgarh, during *kharif* season farmer prefer to grow mungbean in unbunded heavy soil locally known as *Bharri* land. Presently, rice, soybean and pulses occupies 10 per cent (3.4 lakh ha) area under this situation

Mungbean is highly priced and nutritionally rich crop having the source of protein (23.24%), carbohydrates and vitamins. It is consumed in different ways, as dal, halwa, snack and so many other preparations. Sprouted seeds of mungbean contain good amount of riboflovin, thiamine and ascorbic acid (vitamin C). It is also used as a green manure crop. It also provides an excellent green fodder for the animals. Being a short duration crop, it fits well in various multiple

and inter-cropping system. Being a leguminous crop, it has the capacity to fix atmospheric nitrogen through, symbiotic nitrogen fixation. Pulses have been reported to fix about 14.35 mt of N per year. Most of the grain legumes area giving N advantage of 30.5 kg ha^{-1} to succeeding cereal crop. A part from it, non-legumes are also benefitted by legume in association because of N transfer to the legumes directly through decomposing root, leaves and stubbles (Singh, 1992).

REVIEW OF LITERATURE

Nodulation and Phenology

Chaudhary *et al.*(1988) reported that cultivar T-9 accumulated maximum dry matter in stem, leaves, seed and husk, while the lowest being in UPU 9-40-4. The differences in dry matter of stem and seed of different varieties were more apparent than that of leaves and husk. Dry matter $plant^{-1}$ was 5.0, 4.0 and 11.2 per cent higher in T-9 than UG218, Pant U19 and UPU 9-40-4, respectively.

Singh and Singh (2000) revealed that total dry matter accumulation and its partitioning to different parts was in the order of IPU-94-17 > UPU-97-10 > IPU-94-2 > UG 218 > PU 19 at all stages of crop growth, maintenance of more number of trifoliate leaves $plant^{-1}$ was noted in IPU 94-17 at all the stages. Pramanik *et al.* (2002) studied the four varieties of mungbean i.e. local, T-44, Narendra mung and PDM 54, on farm trial at Andaman Nicobar and reported that variety Narendra mung recorded significantly more pods $plant^{-1}$, pod length and seeds pod^{-1} than other high yielding varieties of mungbean. Whereas, Soomrao and Khan (2003) reported that plant height varied among genotypes. Maximum plant height recorded in advanced breeding line M-6 was 60 cm and minimum 51 cm by NM-92. Results are further supported by the findings of Gebologlu *et al.* (1997) and Ram and Dixit (2001).

Yield Attributes and Yield

Sharma *et al.* (1988) reported that cultivar ML-131 gave significantly higher grain yield over GML-73, GMC-47 and Pusa Baisakhi. The remaining cultivars gave the similar yield. Saini and Jaiswal (1991) studied six varieties (PS 16, K 851, PDM and Pusa 105, 11/395 and Pusa Baisakhi) of mungbean and noted that the cultivar 11/395 gave the highest mean yield. Padhi and Sahoo (1991) found that variety PDM 11 recorded the highest yield, followed by Pusa 105 and 11/395, in 1984 and 1985, respectively. Dhauli and K 851, recorded the lowest yield in both year. They also observed that Dhauli, PS 16 and K 851, gave significantly lower yield than PDM 11, Pusa 105 and 11/395. In both the years, variety PDM 11, being a highest yielder gave more pods $plant^{-1}$, seeds pod^{-1} and harvest index followed by Pusa 105 and 11/395.

Siag and Gaur (1995) observed that genotype, K 851 gave significantly higher yield (1059 kg ha^{-1}) than Pusa Baisakhi (911 kg ha^{-1}) and T 44 (831 kg ha^{-1}). This variety was also found superior in yield attributing character. Das *et al.* (1996) observed that the variety VL 63 significantly out yielded in both the years (10.41 and 10.20 q ha^{-1}) than other varieties (PDR-14 and HUR-87) of Frenchbean. Khawas and Bhattacharjee (1996) reported that the varieties differed significantly in respect of pod length, seeds pod^{-1}, 1000 seed weight and grain yield. The grain yield was maximum for varieties PIMS-4 and minimum for PDM-54. Dhanjal *et al.* (2000) reported that among the 5 varieties, Pusa Baisakhi gave the maximum yield being markedly higher over other varieties (PS 105, PS 9032 and K 851). They also found that variety K 851 was the next in order of productivity of mungbean.

MATERIALS AND METHODS

Number and Dry Weight of Nodules

Five plants were randomly selected from each plot at 20, 40 and 60 DAS and carefully excavated along with the soil of the root zone. After carefully removing the soil by repeated washing with water effective nodules were removed and counted. The nodules were kept in an oven for drying at 60°C for 24 hours. Total dry weight was recorded and averaged at each time interval.

Seed Yield (kg ha^{-1})

The crop of each net plot was separately threshed, winnowed and the seed yield was corrected at 14 per cent moisture content. The seed yield was then converted into kg ha^{-1}.

RESULTS

Number of Nodules Plant^{-1}

Data pertaining to number of nodules plant^{-1} in mungbean counted at 20, 40 and 60 DAS are presented in Table 1. Upto 40 DAS, nodules plant^{-1} were observed to increase in number invariably due to different dates of sowing and varieties. But at 60 DAS, a decrease in nodule number was observed under all the dates of sowing and varieties. At later stage of plant growth, most of the nodules degenerated resulting in lesser number under different dates of sowing and also in different varieties. Reduction in nodule number was mainly due to its decay. Sowing of mungbean on 10th July resulted in significantly higher number of nodules than later dates of sowing. The possible reasons responsible for variation in nodulation under advanced and delayed sowing were the effect of temperature, rainfall and length of growing period at vegetative period. Similar results were noted by Chaudhary *et al.* (1988), Gupta and Lal (1989) and Soomrao and Khan (2003).

Regarding varieties, HUM-12 maintained its significant superiority over other varieties for number of nodules throughout the whole period of crop life, except at 20 DAS, where variety RM-06-08 remained at par. The lowest number of nodules was noted under variety Pragya at 20 and 40 DAS and under variety Malviya Jyoti at 60 DAS. Similar results were noted by Chaudhary *et al.* (1988) and Anbalagan (1996). Interaction effects were noted to be non-significant for different periods under observations.

Table 1: Number of Nodules of Mungbean at Different Duration as Affected by Dates of Sowing and Varieties

Treatment	Nodules plant^{-1}, No.		
	20 DAS	40 DAS	60 DAS
Dates of sowing			
D_1 : 10th July	26.05	35.96	27.14
D_2 : 25th July	23.81	33.51	25.39
D_3 : 09th August	18.43	27.66	20.38
D_4 : 24th August	13.21	20.19	15.23
SEm±	**0.134**	**0.17**	**0.078**
CD (P=0.05)	**0.463**	**0.585**	**0.268**
Varieties			
V_1 : TM-99-2	22.63	38.25	24.80
V_2 : Malviya Jyoti	15.75	22.72	16.60
V_3 : ML-5	17.75	23.15	19.38
V_4 : RM-03-07	24.42	33.72	26.33

Table 1: Contd.,

V_5 : Pragya	14.90	22.33	16.97
V_6 : RM-06-08	25.72	35.90	27.32
V_7 : BM-4	22.02	31.57	23.60
V_8 : TM-2002-4	15.79	22.52	17.40
V_9 : ML-131	16.83	24.10	18.28
V_{10} : Pusa Vishal	21.53	35.22	23.52
V_{11} : TM-2000-1	20.83	25.15	22.40
V_{12} : HUM-12	26.17	37.35	27.87
SEm±	**0.184**	**0.177**	**0.099**
CD (P=0.05)	**0.514**	**0.495**	**0.277**

Dry Weight of Nodules Plant^{-1}

It is obvious from the Table 2 that nodules weight differed significantly due to dates of sowing and varieties of mungbean. Upto 40 DAS, dry weight of nodules were observed to increase invariably. But at 60 DAS, a decrease in nodules dry weight was observed under all the dates of sowing and varieties. Sowing on 10th July produced significantly the highest dry weight of nodules than the other dates of sowing in all the stages i.e. 20, 40 and 60 DAS. Whereas, significantly the lowest nodules dry weight was found under 24th August sowing. Similar results were found by Chaudhary *et al.* (1988), Gupta and Lal (1989) and Soomrao and Khan (2003).

Variety TM-99-2 recorded significantly greater dry weight of nodules at 20 DAS being at par with ML-131. Whereas, variety HUM-12 gave significantly the highest dry weight of nodules at the 40 and 60 DAS. The variety Pragya gave the lowest dry weight of nodules at all the stages of observations. Similar results were also noted by Chaudhary *et al.* (1988), Gupta and Lal (1989) and Soomrao and Khan (2003). Interaction effects were also noted to be non-significant for different periods under observations.

Table 2: Dry Weight of Nodules of Mungbean at Different Duration as Affected by Dates of Sowing and Varieties

Treatment	Dry weight of nodules, mg plant^{-1}		
	20 DAS	40 DAS	60 DAS
Dates of sowing			
D_1 : 10th July	16.22	66.21	26.92
D_2 : 25th July	14.79	63.99	24.61
D_3 : 09th August	11.49	58.21	20.25
D_4 : 24th August	8.72	46.97	18.17
SEm±	**0.035**	**0.234**	**0.092**
CD (P=0.05)	**0.122**	**0.805**	**0.317**
Varieties			
V_1 : TM-99-2	17.03	61.95	25.18
V_2 : Malviya Jyoti	9.68	54.45	19.78
V_3 : ML-5	11.41	56.30	20.96
V_4 : RM-03-07	14.91	61.87	23.13
V_5 : Pragya	8.94	49.61	17.34
V_6 : RM-06-08	13.49	62.95	22.84
V_7 : BM-4	13.58	61.53	23.62
V_8 : TM-2002-4	9.28	51.46	18.92
V_9 : ML-131	16.95	65.24	26.62
V_{10} : Pusa Vishal	13.00	56.49	23.07
V_{11} : TM-2000-1	9.76	55.88	20.58
V_{12} : HUM-12	15.61	68.40	27.80
SEm±	**0.078**	**0.297**	**0.290**
CD (P=0.05)	**0.217**	**0.831**	**0.811**

Seed Yield (kg ha^{-1})

The data of yield per plant have been converted into kg ha^{-1} and presented in Table 3. It may be clearly observed from the data that the difference in yield as affected by dates of sowing, varieties and their interaction was found to be significant.

Maximum mean seed yield (506 kg ha^{-1}) was obtained with 10th July sowing which was significantly superior to rest three dates. The lowest seed yield (145kg^{-1}) was noted with 24th August sowing. All the sowing dates differed significantly from each other and the order of their descendance for seed yield was 10th July > 25th July > 9th August and 24th August. It has been concluded from various experiments that the earliest sowing of mungbean gave the highest yield. The seed yield is the resultant of growth and yield attributing characters of a crop. The superiority of growth characters plant height, braches, LAI, dry matter accumulation and nodulation pattern and yield attributes such as pods plant^{-1}, seeds pod^{-1},100 seed weight and podding behaviour as discussed earlier may be the possible reasons for the production of higher yield under 10th July sowing. Similar observations have been reported by Tiwari and Ram (1985), Sharma *et al.* (1988), Chaudhary *et al.* (1988), Jeswani and Baldev (1990), Siag and Gaur (1995), Soomrao and Khan (2003) and Kumar and Singh (2003).

Variety BM-4 produced significantly maximum yield (472 kg ha^{-1}) which was at par with HUM-12 (469 kg ha^{-1}). Both the above mentioned varieties were significantly superior to rest ten varieties. It may due to higher growth and yield attributing characters in these varieties. Varieties Pragya gave significantly the lowest yield (229 kg ha^{-1}). Poor growth of this variety has resulted in reduced yield. Varietal difference for seed yield have been also reported by Tiwari and Ram (1985), Sharma *et al.* (1988), Chaudhary *et al.* (1988), Jeswani and Baldev (1990), Siag and Gaur (1995), Soomrao and Khan (2003) and Kumar and Singh (2003).

Interaction between dates of sowing and varieties were also found to be significant. Sowing of mungbean variety BM-4 on 10th July resulted significantly the highest seed yield (736 kg ha^{-1}) which remained at par to variety RM-03-07 sown on 10th July. Similar observations have been reported by Padhi and Sahoo (1991), Siag and Gaur (1995) and Soomrao and Khan (2003).

Table 3: Seed Yield (Kg Ha^{-1}) of Mungbean as Affected by Interaction between Dates of Sowing and Varieties

Treatment	Seed yield, kg ha^{-1}				
Dates of sowing / Varieties	10th July (D_1)	25th July (D_2)	09th Aug. (D_3)	24th Aug. (D_4)	Mean of varieties
V_1 : TM-99-2	525	512	265	156	**365**
V_2 : Malviya Jyoti	360	335	318	191	**301**
V_3 : ML-5	415	321	247	170	**288**
V_4 : RM-03-07	712	555	342	132	**435**
V_5 : Pragya	330	245	236	105	**229**
V_6 : RM-06-08	690	572	292	118	**418**
V_7 : BM-4	736	568	382	203	**472**
V_8 : TM-2002-4	366	342	221	121	**263**
V_9 : ML-131	380	346	227	107	**265**
V_{10} : Pusa Vishal	515	417	205	109	**312**
V_{11} : TM-2000-1	356	362	195	117	**258**
V_{12} : HUM-12	684	613	368	212	**469**

Table 3: Contd.,

Mean of dates of sowing	506	432	275	145	
			SEm±		CD (P=0.05)
Dates of sowing			4.04		13.93
Varieties			4.96		13.86
For comparing dates of sowing mean at the same level of variety			9.93		27.73
For comparing variety mean at the same level of dates of sowing			10.34		29.89

CONCLUSION

The varieties of mungbean with seed rate of 20 kg ha^{-1} was sown as per sowing dates. Harvesting was done on different dates. The observation on plant population, plant height, number of branches, dry matter accumulation, number and dry weight of nodules, number of flowers and pods, number of pods $plant^{-1}$, seeds pod^{-1}, seeds $plant^{-1}$, 100 seed weight, seed and stover yield were recorded and statistically analyzed.

Number and dry weight of nodules at 20, 40 and 60 DAS were significantly the highest under the first date of sowing i.e. 10th July. Whereas, variety HUM-12 gave the highest number and dry weight of nodules.

The dates of sowing and varieties had a significant effect on yield ha^{-1}. The effect of dates of sowing was more pronounced and highest yield (506 kg ha^{-1}) was obtained under first date of sowing i.e. 10th July. The yield however, progressively and significantly decreased upto 09th August. Variety BM-4 gave the highest seed yield (475 kg ha^{-1}) which was followed by HUM-12. The interaction between dates of sowing and varieties was also found to be significant in affecting seed yield ha^{-1}. Significantly maximum seed yield ha^{-1} was in general, obtained in combination of first date of sowing 10th July with variety BM-4 or RM-03-07.

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