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Full Length Research Paper

Evaluation of *Mucuna utilis* germplasm for higher biomass production, active principle and seed yield

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***Mucuna pruriens* var *utilis* is a high value medicinal crop grown for its seed to extract L-3,4-dihyroxy-phenylalanine (L-DOPA). L-DOPA used against Parkinson's disease although *Mucuna utilis* is having commercial value for its seed, there has been no commercial variety identified for cultivation, superior in seed yield or in active principle. Hence a field study was proposed for evaluation of germplasm for total biomass production, active principle and seed yield. Field experiment was conducted using 13 genotypes to evaluate germplasm for higher biomass production, active principle and seed yield at Indian Institute of Horticultural Research, Bangalore. Results suggested that IIHR MP 09 recorded highest number of bunches per plant, number of pods per bunch, number of seeds per pod. IIHR MP 03 recorded highest pod length (10.40 cm) and pod weight (11.49 g) and IC 33243 recorded highest 100- seed weight (132.06 g). Seed yield (180.88 g m^{-2}) found to be recorded the highest in IIHR MP 09 and active principle L-DOPA per cent in seed sample varied from 6.61 per cent in IIHR MP 02 to 4.11 per cent in IIHR MP 17.**

Key words: *Mucuna pruriens*, seed yield, L-DOPA.

INTRODUCTION

Mucuna is a leguminous, twining annual, having wide distribution in tropical and subtropical areas of the world. It is known commonly as Velvet bean, Cowhide/Cowitch in English, Atmagupta/Kapikacchu in ayurveda, Nasugunni in Kannada. *Mucuna* has gained commercial importance because several species like *Mucuna pruriens*, *Mucuna gigantic*, *Mucuna monosperma, Mucuna cochinchinensis* etc. These species are found to useful by providing L-DOPA (L-3,4-dihydroxy-phenylalanine) in the seeds, the drug which is used to treat the Parkinson's disease in human beings (Nath et al., 1980). Besides its medicinal uses, the plant being a legume is also important in soil amelioration, conservation and fertility improvement (Milton, 1989).

The genus *Mucuna* is a member of family *Leguminoseae*, the roots bear the root nodules for nitrogen fixation it has been found that growing *Mucuna* is useful to the farmers in enriching the soil fertility by way of fixing atmospheric nitrogen (Graham and Scott, 1983; Haser et al., 1992). Hence by cultivating *Mucuna*, barren soil can become fertile. However, there are limited studies reporting extent of nitrogen fixation for development of elite strains/varieties. Hence in this study an attempt is made to evaluate several genotypes of *Mucuna* for higher level of Nitrogen fixation.

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MATERIALS AND METHODS

A filed experiment was conducted for evaluation of *Mucuna* genotypes for optimum biomass, active principle and seed yield. The studies were conducted at Indian Institute of Horticultural Research, Bangalore. The experimental details are given below.

Experimental design : Randomized Complete Block Design
No. of treatments : 13 Genotypes of *Mucuna*
No. of replications : Six
Date of sowing : 16/07/2003
Date of harvest : 22/10/2003
Spacing : 1 x 1 m^2
Area of the micro plot : 69 m^2

Treatments are genotypes of *Mucuna utilis*, IIHR- MP- 01, IIHR- MP -02, IIHR- MP- 03, IIHR- MP- 05, IIHR- MP- 06, IIHR -MP -08, IIHR-

Table 1. Growth parameters plant height (cm), number of leaves *Mucuna utilis* genotypes at 30 DAS, 50 DAS and at harvest.

Treatments	Plant height (cm)	Number of leaves	Plant height (cm)	Number of leaves	Plant height (cm)	Number of leaves
	30 DAS		50 DAS		At Harvest	
IIHR MP 01	82.83	8.66	141.16	22.16	212.17	42.34
IIHR MP 02	94.00	8.83	122.50	22.00	181.67	31.50
IIHR MP 03	82.33	11.67	128.19	27.50	177.34	36.00
IIHR MP 05	101.80	14.67	133.16	22.50	135.67	28.84
IIHR MP 06	70.83	10.50	120.50	22.50	157.84	41.17
IIHR MP 08	91.33	1050	113.16	22.00	120.84	26.17
IIHR MP 09	71.33	8.33	120.16	20.00	182.00	64.17
IIHR MP 10	97.50	10.16	137.66	20.33	155.50	28.00
IIHR MP 11	78.33	9.83	128.16	20.16	179.67	39.17
IIHR MP 16	86.66	12.16	113.34	21.66	115.00	24.67
IIHR MP 17	92.83	12.50	118.50	25.66	129.34	32.34
IC 16993/A	70.33	11.50	115.30	26.16	130.34	31.84
IC 33243	73.50	11.50	140.50	28.50	152.58	34.50
Mean	84.34	10.51	125.57	23.58	156.15	40.06
S.Em+/-	8.28	1.06	14.40	2.32	17.57	5.79
CD at 5%	NS	2.99	NS	NS	NS	16.37

DAS: days after sowing.

MP -09, IIHR -MP -10, IIHR- MP- 11, IIHR- MP -16, IIHR- MP- 17, IC -16993/A,IC 33243.

Experimental observations

Sampling Technique: Six plants from each treatment for growth parameters and ten plants for yield parameters were selected at random avoiding the border row plants for recording various growth, yield and quality parameters.

Growth parameters

% germination, plant height, number of leaves per plant, disease incidence are recorded at regular intervals (30 days after planting, 50 days after planting and at harvest).

Yield parameters

Number of bunches/plant, number of pods per plant, number of seeds per plant, test weight of seeds, pod length, pod weight, number of nodules/plant are recorded.

Determination of active ingredient (L-DOPA)

The active ingredient (L-DOPA) content was determined after harvest in seeds by High Performance Liquid Chromatography (HPLC) method following standard procedure (Shivananda et al., 2003).

Extraction of L-DOPA from seeds was done with 0.1 m orthophosphoric acid and estimation is done with HPLC, using spherisorb column 5 µm OD 52 using sodium dihydrogen phosphate as mobile phase at pH 2.8. Retention time of sample is 3.5 to 3.8 min. % L-DOPA was calculated by comparing peak area of sample with peak area of standard.

L- DOPA= Test area/Standard area X Standard (L-DOPA) weight/ Standard dilution X Test solution/Test weightX98.5/100X100.

RESULTS AND DISCUSSION

For the identification of elite germplasm for higher active principle and seed yield, growth parameters like plant height (cm) and number of leaves per plant were recorded at 30 days after sowing (DAS), 50 DAS and at harvest, yield parameters were recorded at harvest. From the seeds collected from each genotype, L-DOPA (%) was estimated using HPLC (High Performance Liquid chromatography).

Growth parameters

Growth parameters like plant height (cm) and number of leaves were recorded at 30 DAS, 50 DAS and at harvest. Data pertaining to this was presented in Table 1.

Plant height (cm) at 30 DAS did not show any significant difference across genotypes. However, the highest plant height was observed in IIHR MP 05 and the lowest plant height in IC 33243. At 50 DAS, there was no significant difference in plant height (141.16 cm) in IIHR MP 01, while the lowest plant height (128.16 cm) in IIHR MP 11.

At harvest, a significant difference in plant height was observed. Highest plant height (212.17) was observed in IIHR MP 01, while the lower (115 cm) plant height in IIHR

Table 2. Estimation of L-DOPA (%) in seeds of *M. utilis* genotypes.

Treatments	L-DOPA (%)
IIHR MP 01	5.21
IIHR MP 02	6.61
IIHR MP 03	5.01
IIHR MP 05	6.16
IIHR MP 06	4.12
IIHR MP 08	4.22
IIHR MP 09	5.11
IIHR MP 10	5.44
IIHR MP 11	5.14
IIHR MP 16	5.34
IIHR MP 17	4.11
IC 16993/A	4.32
IC 33243	4.44
S.Em+/-	0.29
CD at 5%	0.90

Table 3. Yield attributes of *Mucuna utilis* genotypes in field experiment at harvest.

Treatments	number of bunches per plant	number of pods/bunch	pod length (cm)	pod weight (g)	number of seeds per pod	100 seed weight (g)	seed yield (g m^{-2})
IIHR MP 01	5.29	3.28	7.90	5.55	4.27	78.47	94.42
IIHR MP 02	8.3	3.32	7.90	7.41	3.82	80.25	131.17
IIHR MP 03	4.90	2.80	10.40	11.49	3.58	111.68	53.98
IIHR MP 05	10.10	3.50	8.40	7.88	3.68	123.65	105.21
IIHR MP 06	9.60	3.07	9.65	9.74	3.39	98.71	101.20
IIHR MP 08	5.60	2.59	8.55	6.95	3.45	118.74	52.14
IIHR MP 09	10.40	3.60	7.80	6.83	4.30	89.01	180.88
IIHR MP 10	6.20	2.66	6.85	5.07	3.57	77.68	95.70
IIHR MP 11	6.40	3.54	7.67	5.71	3.92	79.36	111.90
IIHR MP 16	2.90	2.54	8.91	7.71	3.04	85.03	46.33
IIHR MP 17	5.60	2.57	7.55	4.95	2.66	128.60	49.76
IC 16993/A	3.90	2.70	9.27	6.99	3.55	122.26	50.57
IC 33243	3.90	3.09	7.70	8.28	3.31	132.06	50.21
S.Em+/-	1.09	0.20	0.24	0.65	0.21	1.85	2.51
CD at 5%	3.04	0.57	0.67	1.80	0.59	5.43	7.68

MP 16.

Number of leaves per plant varied non-significantly at 50 DAS, but at 30 DAS and at harvest varied significantly. At 30 DAS IIHR MP 05 recorded maximum number of leaves per plant and at harvest IIHR MP 09 recorded highest number of leaves per plant. The maximum number of leaves per plant due to more height of plant, production of more number of branches, due to increase in lateral bud formation.

L-DOPA (%)

L-DOPA (%) in seed samples varied significantly. Data pertaining to this was presented in Table 2. L-DOPA contents in seed sample varied from 6.61 per cent in IIHR MP 02 to 4.11 per cent in IIHR MP 17. This is probably due to variation of precursor compounds L-Dopa present in the seeds. Such similar variations have been reported by Shivananda et al. (2004A), Chandrashekar (2002), Poornachandra (1999) and Tewari and Prakash (1999).

Yield parameters

Yield parameters like number of bunches per plant, number of pods/bunch, pod length (cm), pod weight (g), number of seeds per pod, 100 seed weight (g) varied

significantly. Data pertaining to this was presented in Table 3. IIHR MP 09 recorded highest number of bunches per plant (10.40), number of pods/bunch (3.60), number of seeds per pod (4.30). IIHR MP 03 recorded highest pod length (10.40 cm) and pod weight (11.49 g) and IC 33243 recorded highest 100 seed weight (132.06 g).

Highest seed yield (180.08 g m^{-2}) recorded in IIHR MP 09 was apparently due to the highest number of bunches per plant, number of pods/bunch, number of seeds per pod.

Conclusion

Growth parameters like plant height (cm) and number of leaves per plant recorded at different stages of plant growth suggested that there was no significant difference across genotypes. Yield parameters varied significantly. IIHR MP 09 recorded highest number of bunches per plant, number of pods/bunch, number of seeds per pod. IIHR MP 03 recorded highest pod length (cm) and pod weight (g) and IC 33243 recorded highest 100 seed weight (g). L-Dopa (%) in seed sample varied from 6.61 per cent in IIHR MP 02 to 4.11 per cent in IIHR MP 17.

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