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Evaluation of velvet bean (*Mucuna pruriens* L.) genotypes for growth, yield, L-dopa content and soil nitrogen fixation in rubber plantation under hill zone of Karnataka

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Abstract
Mean performance of 11 velvet bean (*Mucuna pruriens* L.) genotypes for growth, yield and quality attributes indicated significant differences among the genotypes for all characters studied the genotype Arka Danavantri recorded significantly maximum vine length (294.13 cm), number of trifoliate leaves (93.57), number of branches (5.60), stem girth (6.81 mm), leaf area (18740.73 cm^2), chlorophyll content (49.03 SPAD units), days to flower bud initiation (119.93), days to 50 per cent flowering (137.00), days to pod maturity (197.80), number of flowers per inflorescence (19.07), number of bunches per plant (4.87), number of pods per bunch (5.07), pod yield (154.69 g), seed yield (82.37 g), L-DOPA content (3.74 %) and its yield (3.08 g/plant) and (114.17 kg/ha) and soil nitrogen fixation (22.67 kg/ha).

Keywords: Velvet bean, Genotypes, Growth, Yield, Quality

Introduction
Velvet bean (*Mucuna pruriens* L.) is a leguminous, twining annual climber widely distributed in tropical and subtropical areas of the world. It is commonly known as *cowitch* and *cowhage* (English), *kapikachu* and *kiwach* (Hindi), *atmagupta* and *kapikacchu* (Sanskrit), *nasugunnikaayi* and *turuchigida* (Kannada). Velvet bean is endemic to India and other parts of tropics including America and South Africa. It is cultivated in Bangladesh, India, Sri Lanka, South East Asia and Malaysia.

All parts of velvet bean possess valuable medicinal properties. It is used against a wide range of disorders such as urinary tract, neurological and menstruation disorders, constipation, edema, fever, tuberculosis, ulcers, Parkinson's disease (Katzenschlager *et al*., 2004) [3] and helminthiases like elephantiasis. Leaves are useful in ulcers, inflammation, cephalagia and general debility. Dried leaves of *M. pruriens* are sometimes smoked. The pods are covered with coarse hairs called as trichomes which cause itching, blisters and dermatitis. Pods are also used as vegetable. The seeds of velvet bean are rich in protein **(**20-29%), lipids **(**6-7%**),** dietary fiber **(**8-10%**),** ash (3%), carbohydrates (50-60%) and minerals. Also they are extremely rich in alkaloids, saponins and sterols. It is recognized as an aphrodisiac in *Ayurveda* and helps to increase testosterone levels leading to deposition of protein in the muscles and increased muscle mass and strength.

Besides its medicinal uses, *M. pruriens* L. is used as an important fallow and green manure crop. Since the plant is a legume, it fixes nitrogen and fertilizes soil by soil amelioration, conservation and fertility improvement. Owing to its innumerable medicinal uses the demand for this climber seems to increasing but for commercial cultivation of this crop to cope up the demand genetically stable, high seed yield and L-DOPA yielding genotypes under rubber plantation are not identified. Hence, the present study was undertaken for identification of potential genotypes.

Materials and Methods
Eleven genotypes obtained from different sources were evaluated during *rabi* season 2015-16

at experimental block of Zonal Agricultural and Horticultural research station, Mudigere in Randomized Complete Block Design with three replication at 60cm x 45cm spacing. Recommended agronomical practices were followed to raise the crop. The morphological observation such as vine length, number of trifoliate leaves, number of branches, stem girth, leaf area, chlorophyll content, days to flower bud initiation, days to 50 per cent flowering, days to pod maturity, number of flowers per inflorescence, number of bunches per plant, number of pods per bunch, pod length, pod width, pod yield, seed yield, test weight of seeds, L-DOPA content, L-DOPA yield and soil nitrogen fixation were recorded on 5 randomly selected plants from each replications. The total L-DOPA content was estimated from powdered dried seed samples by HPLC analysis.

Results and Discussion

Analysis of variance revealed that significant differences among the genotypes for all the characters indicating greater variability for further genetic studies and identification of potential genotypes which could yield high pod and seed yield and total L-DOPA content and its yield (Table 2 and 3). The maximum pod yield per plant was recorded in genotype Arka Dhanvantari (154.69 g) which was on par with genotypes IIHR Selection -2 (140.98g), IC 471876 (137.31 g) and IIHR Selection -10 (137.11 g). The increased pod yield was mainly due to increased vine length (294.13cm), number of leaves (70.47), number of bunches per plant (4.87) and number of pods per bunch (5.07). These results are in conformity with the findings of Pugalenthi and Vadivel (2007) [6], Mamatha *et al*. (2010) [5] and Vinay (2015) [9] in velvet bean.

The seed yield per plant was significant and highest in the genotype Arka Dhanvantari (82.37 g) and it was on par with genotype IIHR Selection -2 (78.47 g). The increased seed yield was mainly due to increased pod yield, number of pods per plant and number of pods per bunch. These results are in conformity with the findings of Gurumoorthi *et al.* (2003) [2], Pugalenthi and Vadivel (2007) [6], Mamatha *et al*. (2010) [5] and Vinay (2015) [9] in velvet bean.

The total L-DOPA content varied significantly among the genotypes. The maximum L-DOPA content was recorded in genotype Arka Dhanvantari (3.74 %) and it was on par with genotypes IIHR Selection -2 (3.62 %), IIHR Selection -8 (3.23 %), Arka Ashwini (3.49), IC 369144 (3.32 %) and IC 385926 (3.44 %). Whereas, the lowest L-DOPA content was recorded in genotype IC 395193 (2.34 %). This difference in L-DOPA content is might be due to variation of precursor compounds of L-DOPA present in the seeds and also influence of genotype and environmental interactions. These findings are in agreement with the results reported by Vadivel and Janardhan (2000) [8], Archana and Renu (2011) [1], Mahesh and Sathyanarayana (2011) [4], Raina *et al*. (2012) [7] and Vinay (2015) [9] in *Mucuna pruriens* L.

Significant difference was observed for L-DOPA yield per plant in different genotypes of velvet bean. Significantly maximum L-DOPA yield per plant was recorded in the genotype Arka Dhanvantari (3.08 g/plant) which was followed by genotype IIHR Selection -2 (2.84 g/plant). Whereas, the genotype IIHR Selection -3 produced least L-DOPA yield per plant (1.35 g/ plant). Similar variation has been reported by Vinay (2015) [9] in *Mucuna pruriense* L.

Genotypes showed significant differences with respect to nitrogen fixation in soil. The maximum nitrogen fixation in soil was recorded in the genotype IIHR Selection -2 (33.33 kg ha^{-1}) followed by Arka Dhanvantari (22.67 kg ha^{-1}) genotype. This increase in 'N' fixation might be due to the increased number of root nodules per plant (13.53) and nodule weight (13.47 mg /plant) as it fixes the atmospheric nitrogen in the soil. While, the nitrogen fixation in soil was reported minimum in Tarikere local (8.67 $kgha^{-1}$). Similar findings were also reported by Sanginga (2003), Ceballos *et al*. (2012) and Vinay (2015) [9] in velvet bean.

Conclusion

From the present investigation it is concluded that among 11 genotypes studied, the genotype Arka Dhanvantari performed well and out yielded all other genotypes with respect to growth, yield, quality and soil nitrogen fixation.

Table 1: Mean performance of velvet bean genotypes for vegetative characters in rubber plantation under hill zone of Karnataka

Genotypes	Vine length at harvest (cm)	Number of trifoliate leaves at harvest	Number of branches at flowering	Stem girth at harvest (mm)	Leaf area per plant (cm^2) at harvest	Chlorophyll content (SPAD units)
IIHR Selection -2	288.33	73.80	5.27	7.10	18600.97	47.11
IIHR Selection -3	245.17	66.07	4.33	5.13	14983.57	42.57
IIHR Selection -8	251.40	67.07	4.53	5.97	16050.93	43.71
IIHR Selection -10	258.87	65.73	4.67	6.16	17389.86	46.77
Arka Ashwini	256.13	66.27	4.53	6.00	14518.04	44.73
Arka Dhanvantari	294.13	93.57	5.60	6.81	18740.73	49.03
IC 369144	254.53	63.33	4.47	5.92	11068.82	41.17
IC 385926	247.00	68.33	4.73	5.74	13879.54	42.31
IC 395193	251.07	64.13	4.60	5.86	16086.67	43.25
IC 471876	257.73	69.40	4.47	5.32	17998.25	45.41
Tarikere local	230.27	62.93	3.93	5.91	13428.95	41.93
S.Em ±	8.30	1.15	0.24	0.32	441.59	1.25
CD at 5%	25.69	3.58	0.74	1.00	1302.68	3.69

Table 2: Mean performance of velvet bean genotypes for yield attributes in rubber plantation under hill zone of Karnataka

Genotypes	Days to flower bud initiation	Days to 50 per cent flowering	Days to pod maturity	Number of flowers per inflorescence	Number of bunches per plant	Number of pods per bunch	Pod length (cm)	Pod width (cm)	Pod yield per plant (g)	Seed yield per plant (g)	Test weight of seeds (g)
IIHR Selection -2	67.67	74.33	157.00	11.80	4.60	4.73	9.24	1.67	140.98	78.47	97.83
IIHR Selection -3	64.33	71.67	145.67	5.07	4.42	2.40	9.24	1.73	110.43	57.09	114.86
IIHR Selection -8	68.20	78.00	146.00	5.93	4.20	2.93	9.49	1.81	122.87	58.81	122.71
IIHR Selection -10	72.93	81.00	144.47	7.93	4.53	3.27	8.98	1.87	137.11	64.99	128.84
Arka Ashwini	54.00	62.00	141.67	5.87	4.33	3.20	10.42	2.01	118.08	63.96	130.95
Arka Dhanvantari	119.93	137.00	197.80	19.07	4.87	5.07	8.72	1.79	154.69	82.37	85.50
IC 369144	56.40	65.33	142.27	4.33	4.47	2.80	7.18	1.77	113.89	56.99	116.46
IC 385926	58.73	66.67	143.20	4.67	4.40	2.53	9.42	1.81	115.97	59.50	128.58
IC 395193	70.20	76.67	147.00	4.60	4.40	2.47	9.54	1.79	111.53	60.84	132.49
IC 471876	60.53	71.00	149.40	4.47	4.57	2.40	10.17	1.73	137.31	65.07	111.69
Tarikere local	62.07	68.33	149.67	4.00	3.47	2.33	9.53	1.79	105.61	55.54	119.58
S.Em ±	2.28	2.07	4.37	0.20	0.12	0.11	0.23	0.04	6.07	2.10	0.27
CD at 5%	7.07	6.43	13.53	0.64	0.38	0.36	0.72	0.15	18.80	6.52	0.84

Table 3: Mean performance of velvet bean genotypes for L-DOPA content and soil nitrogen fixation in rubber plantation under hill zone of Karnataka

Genotypes	L-DOPA content (%)	L-DOPA yield (g/plant)	L-DOPA yield (kg/ha)	Number of root nodules per plant	Nodules weight per plant (mg)	Soil nitrogen content (kg/ha)		Estimated soil nitrogen fixation (kg/ha)
						Pre - sowing	After harvest	
IIHR Selection -2	3.62	2.84	105.24	13.53	13.47	488.33	521.67	33.33
IIHR Selection -3	2.36	1.35	49.93	8.13	6.99	408.67	427.00	18.33
IIHR Selection -8	3.23	1.90	70.24	8.60	7.10	472.33	489.33	17.00
IIHR Selection -10	2.75	1.79	66.18	13.07	10.57	441.00	461.00	20.00
Arka Ashwini	3.49	2.23	82.56	7.73	8.32	504.33	517.67	13.33
Arka Dhanvantari	3.74	3.08	114.17	12.67	12.87	393.67	416.33	22.67
IC 369144	3.32	1.89	70.04	7.71	8.89	519.67	534.00	14.33
IC 385926	3.44	2.05	75.79	10.80	9.43	581.33	594.33	13.00
IC 395193	2.34	1.42	52.76	9.53	9.22	472.33	485.00	12.67
IC 471876	2.56	1.67	61.79	7.93	7.10	457.33	472.00	14.67
Tarikere local	2.92	1.62	60.13	7.00	6.10	441.67	450.33	8.67
S.Em ±	0.27	0.07	2.65	0.59	0.49	0.50 1.91	0.50 1.91	1.60
CD at 5%	0.80	0.22	8.96	1.75	1.44	1.47 5.63	1.47 5.63	4.72

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