



Genotype selection for agronomical trait – seed yield in kewachh {*Mucuna pruriens* (L.)}



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ABSTRACT

Mucuna {*Mucuna pruriens* (L.)} is a climber plant belonging to the family 'Fabaceae', found as the wild/cultivated form in subtropical/tropical areas worldwide. The present experiment/study was carried out to determine the adaptability and stability among forty genetic stocks of velvet beans assembled from different places in India for high and stable seed yield by using AMMI analysis. Five high seed yielding and most stable genetic stocks, namely G-37, G-30, G-8, G-23 and G-18, were identified based on seed yield performance for commercial exploitation. The performance-wise mean data of seed yield indicated that one genotype G-37 = 57.03 (ql/ha) was selected for stable and high seed yield. Based on the AMMI model, these five genotypes of *Mucuna* showed the widest adaptability and stability over the years.

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1. Introduction

Mucuna {*Mucuna pruriens* (L.)} is a climber plant belonging to the family 'Fabaceae', found as the wild/cultivated form in subtropical/tropical areas worldwide. *M. pruriens* (syn. *Dolichos pruriens*) is a tropical legume known by a common name Kewachh. *Mucuna* is grown wild in India, Africa, and in the Caribbean countries. *Mucuna* seeds are beneficial, since seeds are high in levodopa which is used to maintain healthy cholesterol and blood sugar levels. The seeds of kewachh are used in traditional, Ayurvedic and Indian system of medicine for many diseases including Parkinsonism (Khanuja et al., 2007). It is also used as a cover crop for tropical areas, and in some parts of India green bean seeds are used as a vegetable.

The basic information on wide adaptability and stability in *M. pruriens* is lacking (Lal et al., 2004). The objectives of this study were to work out the adaptation strategies from multiyear seed yield field trials and cultivar recommendations among forty accessions of *M. pruriens* crop. Basically, the adaptation strategy objectives focus on responses of all genotypes to obtain indications and generate predictions related to future breeding material that may be produced from the genetic base of the tested genotypes for cultivar recommendation (Annicchiarico, 2002; Akçura et al.,

2005; Lal, 2007, 2012, 2014). High yield stability usually refers to a genotype's ability to perform consistently, whether at high or low yield levels, across a wide range of years (Annicchiarico, 2002; Lal, 2014). Many biometrical, univariate and multivariate methods are used to assess stability among different crops (Akçura et al., 2005; Lal, 2012, 2014); between them the most widely used are the regression coefficient (Finlay and Wilkinson, 1963), the environmental variance (Lin et al., 1986; Purchase, 1997; Leeqvner, 2005; Prasad et al., 2007), the Shukla's (Shukla, 1972) stability variance and Wricke's ecovalence (Wricke, 1962). More recently, the AMMI stability value (ASV) based on the AMMI (Additive Main Effects and Multiplicative interactions) model's PCA1 and PCA2 (Principal Components Axis 1 and 2, respectively) scores for each genotype (Lal et al., 2000; Leeqvner, 2005; Lal, 2014).

The concept of yield stability and reliability with high seed yield in genotypes has been demonstrated by Eskridge, 1990; Kang and Pham, 1991 in separate crops, where stable and reliable genotypes are expressed by continuously high seed yield over the years/environments (Annicchiarico, 2002). The use of a yield reliability index facilitates variety selection or recommendation, as the mean yield and the yield stability are combined into a unique measure of genotype merit (Annicchiarico, 2002).

Studies on stability by genotype × environment interaction ($g \times e$) using AMMI model are very meager and or nil in *M. pruriens* crop. In other words no stability and reliability studies have been performed and tested together in a multiyear seed yield trial on *M. pruriens*. Therefore, the objectives of present investigation were to evaluate the seed yield of forty *Mucuna* genotypes for 3 years in

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Table 1
List of genotypes/cultivar and their origin/places of collection of *Mucuna* genotypes.

S.No.	Codes	Genotypes/cultivar	Mean seed yield	L-Dopa content (%)	Origin/places of collection
1	G1	MUC-1	18.77	4.50	Bangalore, Karnataka (India)
2	G2	MUC-2	19.16	5.60	Mangalore, Karnataka (India)
3	G3	MUC-3	21.18	5.60	Phagwara, Punjab (India)
4	G4	MUC-4	18.36	6.14	Barabanki, U.P. (India)
5	G5	MUC-5	19.82	6.62	Shillong, Meghalaya (India)
6	G6	MCW-6	18.03	5.53	Chhattisgarh (India)
7	G7	MUC-7	19.39	5.00	CSIR-CIMAP, Lucknow, U.P. (India)
8	G8	MUC-8	41.58	4.95	Chandigarh
9	G9	MUC-9	19.11	3.50	Chandigarh
10	G10	MUC-10	19.56	4.20	CSIR-CIMAP, Lucknow, U.P. (India)
11	G11	MUC-11	17.58	3.95	Rewari, Haryana (India)
12	G12	MUC-12	19.40	1.70	CSIR-CIMAP, Lucknow, U.P. (India)
13	G13	MUC-13	20.80	5.10	Mangalore, Karnataka (India)
14	G14	MUC-14	16.58	3.36	Muzaffarpur, Bihar (India)
15	G15	MUC-15	20.50	2.50	CSIR-CIMAP, Lucknow, U.P. (India)
16	G16	MUC-16	18.34	2.75	Udaipur, Rajasthan (India)
17	G17	MUC-17	20.90	2.60	Udaipur, Rajasthan (India)
18	G18	MUC-18	20.84	2.50	Bareilly, Uttaranchal (India)
19	G19	MUC-19	18.92	3.42	CSIR-CIMAP, Lucknow, U.P. (India)
20	G20	MUC-20	15.99	4.20	Bangalore, Karnataka (India)
21	G21	MUC-21	19.94	3.00	Trivandrum, Kerala (India)
22	G22	MUC-22	19.88	1.95	Lucknow, U.P. (India)
23	G23	MUC-23	21.49	4.15	Allahabad, U.P. (India)
24	G24	MUC-24	19.02	1.50	Haridwar, Uttaranchal (India)
25	G25	MUC-25	13.88	3.50	Lakhimpur (Kheri), U.P. (India)
26	G26	MUC-26	50.90	4.35	CSIR-CIMAP, Lucknow, U.P. (India)
27	G27	MUC-27	18.79	5.28	Nasik, Maharashtra (India)
28	G28	MUC-28	19.23	2.14	Lucknow, U.P. (India)
29	G29	MUC-29	20.90	3.85	CSIR-CIMAP, Lucknow, U.P. (India)
30	G30/CIM Ajar	MUC-30	45.37	1.60	CSIR-CIMAP, Lucknow, U.P. (India)
31	G31	MUC-31	12.69	1.40	CSIR-CIMAP, Lucknow, U.P. (India)
32	G32	MUC-32	16.68	4.90	Lucknow, U.P. (India)
33	G33	MUC-33	15.00	5.60	Kerala (India)
34	G34	MUC-34	17.17	5.70	CSIR-CIMAP, Lucknow, U.P. (India)
35	G35	MUC-35	19.71	5.00	Jammu, J. and K. (India)
36	G36	MUC-36	18.87	4.50	Chennai, A.P. (India)
37	G37/Sel.-2	MUC-37	57.03	6.18	CSIR-CIMAP, Lucknow, U.P. (India)
38	G38	MUC-38	16.23	3.95	Gandhi Nagar, Gujarat (India)
39	G39	MUC-39	45.82	4.45	Razaganj, U.P. (India)
40	G40	MUC-40	11.96	4.25	Rishikesh, Uttaranchal (India)

Indian environmental conditions, especially in North India and to determine their stability and reliability for the selection of stable varieties.

2. Materials and methods

Forty native collections, representing fifteen states of India (Uttar Pradesh, Uttaranchal, Rajasthan, Haryana, Bihar, Punjab, Madhya Pradesh, Gujarat, Delhi, Jammu and Kashmir, Maharashtra, Karnataka, Kerala, Andhra Pradesh and Meghalaya), of velvet beans (*M. pruriens* (L.) DC.) belonging to family 'Fabaceae', constituted the material for the present study (Table 1). They were evaluated at the Research Farm of CSIR – Central Institute of Medicinal and Aromatic Plants, P.O. CIMAP, Lucknow, U.P. 226 015 (India) – in

the three consecutive growing seasons/years: 2010–11, 2011–12 and 2012–13 in Northern Indian plain's environments in a randomized complete block design with two replications. The plants were planted in 40 cm × 40 cm rows to row/plants to plant distance. The normal intercultural operations, irrigations, and fertilizers (20 kg P₂O₅, and 20 kg K₂O per hectare) were provided in all the experiments over the years. Plants were harvested at maturity stage as an annual crop.

2.1. Statistical analysis

Stability parameter calculations were performed for seed yield (ql/ha) only using MATMODEL VERSION 3.0 program mode: fitting AMMI Model software (Gauch, 2007).

Table 2
ANOVA for model AMMI 1 of *Mucuna* genotypes.

Source	d.f.	SS	MS	Probability
Treatments	119	121,103.89	1017.68	0.399
Genotypes	39	37,739.22	967.67	0.497
Environments/years	2	5552.45	2776.22	0.061
G × E	78	77,812.23	997.59	0.449
IPCA1	40	70,566.15	1764.15	0.004**
Residual	38	7246.08	190.69	1.00
Error	240	235,209.68	980.040	
Total	359	356,313.58	992.52	

Grand mean = 22.33 ql/ha seed yield.

** p < 0.01 level of significance

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