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Evaluation of Dolichos Genotypes (*Dolichos lablab* L.) under Northern Telangana Zone

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Abstract

A field trial was conducted at Horticultural Research Station, Adilabad of Northern Telangana Zone in Telangana State, India for two consecutive years of 2018 and 2019 with forty five genotypes of dolichos bean. The study was initiated to study the vegetative, floral characters and yield performance of different genotypes. The experiment was laid by adopting Randomized block design with two replications each in 2018 and 2019. Significant variations were noticed in the vegetative, floral characteristics; yield attributes and yields among the different genotypes. Stem pigmentation varied from meager or no pigmentation in 33 genotypes to almost solid in IC-426968 and IC-427428. The leaf colour was green and dark green in 12 and 33 genotypes respectively. The leaf shape was round (IC-426968), lanceolate, ovate lanceolate and ovate in 2, 10 and 32 genotypes. The standard petal colour and keel petal colour varied among the genotypes. It was cream, pink, purple and white. Maximum pod length was reported by IC-427436 and IC-427462 (16.15 cm), mean pod width by PSRJ-12953 (6.36 cm), mean pod weight by IC-427436 (11.05 g) and number of seeds per pod (6.35) by genotype Sambram. The genotype IC-427436 recorded significantly higher pod yield per plant (2713 g) and pod yield per hectare (13563 kg) over rest of the genotypes and it was followed by the genotypes IC-427462 and RND-1.

Keywords: Dolichos bean, vegetative, floral characters, yield attributes, yield

1. Introduction

Dolichos bean (*Dolichos lablab* L.) belongs to family fabaceae with 2n=22 chromosomes (Goldblatt, 1981) and commonly known as field bean, hyacinth bean, kidney bean, garden bean, Indian bean, Egyptian bean, Bonavist bean, Sem etc (Shivashankar and Kulkarni, 1989). Dolichos bean is believed to have been originated in India (Nene, 2006) as it is documented by archaeo-botanical finds in India from 2000 to 1700 BC at Heller, the earliest Iron –Age site in Karnataka to 1200-300 BC at veerapuranam excavation site in Andhra Pradesh (Fuller, 2003). Dolichos bean occupies a unique position as a vegetable among the legume crops due to its high nutritious value (Basu et al., 2002, Biju et al., 2001). It is a good source of protein, minerals and vitamins (Golani et al., 2007). It is rich in protein (1.7 g), calcium (132 mg), thiamine (0.08 mg) and vitamin C (24 mg) per 100 g of edible pods. It has anti-diabetic property and is

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good for natural cure of bladder burns and cardiac problems, diarrhoea, sciatica and tenesmus. It is grown for its tender fleshy green pods, shelved green seeds and also dry beans. It is intercropped with maize, finger millet and sorghum in south India under rainfed conditions. In India, the major field bean growing areas are Karnataka, Tamilnadu and Telangana. In Telangana, it occupies an area of 6050 ha with a production of 63306 MT and a productivity of 1046 kg ha^{-1} (Anonymous, 2017). In pure crop stands, the productivity of dry seed yield is 1.5 t ha^{-1}, while it is 0.4-0.5 t ha^{-1} in inter cropping system (Shivashankar and Kulkarni, 1989).

Despite the wide range of adaptability and diversity, it remains as an underutilized crop in many of these regions (Engle and Altoveris, 2000). However, its potential as a vegetable, pulse, forage, cover and green manure crop (Adebisi and Bosch, 2004) and suitability to tropical agricultural production systems (Ebert, 2014) was reported. The consumer preference also varies with pod size, shape, and colour.

A wide range of variations exists for vegetative, floral and pod characters among the accessions grown all over the country. Islam et al., 2010, Mohan et al., 2009, Chattopadhyay et al., 2010 and Deo Shankar et al., 2011 noticed wide variations in most of the morphological or phenotypic traits in dolichos bean.

The success of any breeding programme in general and improvement of specific rate through selection depends upon the genetic variability present in the germplasm of a particular crop (Parmer et al., 2013a and 2013b). Plant characters are governed by poly genes and greatly influenced by environment conditions. Among the quantitative characters yield is a complex character which is dependent on a number of yield contributing characters (Savitha, 2008).

Characterization aids in meaningful grouping of accessions, development of core collection and identification of gapes and retrieval of desired accessions from germplasm data base for using crop reading. Being easily assayable and exhibits stable and simple inheritance (Smith and Smith, 1992) they serve as diagnostic markers of germplasm accessions for their maintaining their identity and purity. Evaluation provide better inside about the composition of the collection and its genetic diversity and hence foster greater use of germplasm and plant breeding. Increased use of germplasm contribute to diversifying crop cultivar genetic base and continued genetic improvement to cater to the needs of changing consumer and end user preferences and address biotic and abiotic stresses. Hence a comprehensive germplasm collection, characterization, evaluation and identification of suitable genotypes for Northern Telangana Zone were initiated.

2. Materials and Methods

The investigation was carried out during 2018 and 2019 at Horticultural Research Station, Adilabad (79° 56' 03" E longitude and 19° 08' 09"N latitude) in Northern Telangana region of Telangana state. The experimental soil was sandy clay loam in texture, neutral in reaction, medium in available nitrogen, phosphorous and potassium. The experiment was laid out in randomized block design with two replications in 2018 and 2019. The seeds of 45 genotypes brought from National Bureau of Plant Genetic Resources (NBPGR), Vegetable Research Station, Hyderabad, local collections from Adilabad and Warangal districts (Table 1) were sown on 26th

Table 1: Source of germplasm/ genotype/ accessions

Genotype	Source
ADP-1	Mavala, Adilabad
ADP-2	Rythubazar, Adilabad
ADP-3	Mavala, Adilabad
ADP-4	Teachers Colony, Adilabad
ADP-5	Dasnapur, Adilabad
ADP-6	KRK Colony, Adilabad
ADP-7	Ankoli, Adilabad
ADP-8	Boath, Adilabad
ADP-9	Boath, Adilabad
ADP-10	Boath, Adilabad
ADP-11	Mediguda, Adilabad
ADP-12	Vegetable Research Station, Rajendranagar, Hyd
ADP-13	Boath, Adilabad
ADP-14	Warangal
RDG-26	Plant breeder, SKLTSHU
RDG-14	Plant breeder, SKLTSHU
Sambhram	NBPGR
PSRJ-12953	NBPGR
IC-426950	NBPGR
IC-426974	NBPGR
IC-384066	NBPGR
IC-598467	NBPGR
IC-427424	NBPGR
IC-427423	NBPGR
IC-427416	NBPGR
IC-426968	NBPGR
USRAM-01-209	NBPGR
IC-426975	NBPGR
IC-426988	NBPGR
IC-446583	NBPGR
IC-427437	NBPGR
IC-427429	NBPGR

Table 1: Continue...

Genotype	Source
IC-546388	NBPGR
IC-446591	NBPGR
IC-446580	NBPGR
IC-446564	NBPGR
IC-427462	NBPGR
IC-427428	NBPGR
IC-427436	NBPGR
RND-1	Vegetable Research Station, Rajendranagar, Hyd
NSJ-398/RDG-33	Plant breeder, SKLTSHU
RDG-3/IC-26131	Plant breeder, SKLTSHU
1	Plant breeder, SKLTSHU
2	Plant breeder, SKLTSHU
3	Plant breeder, SKLTSHU

June, 2018 and 2nd July, 2019 by dibbling three seeds hill^{-1} at a distance of 1 m with-in the row and 2 m between rows. The plots were irrigated immediately after sowing. Thinning and gap filling was taken up at 10 days after germination. Need based plant protection measures were taken up by spraying neem oil @ 5 ml l^{-1} of water for control of aphids and plethora (Novaluron 5.25%+Indoxicarb 4.5%) @ 2 ml l^{-1} of water for control of pod borers. The observations were recorded from 3 randomly selected plants from each genotype in each replication. The data recorded on vegetative and inflorescence was as per the descriptors depicted in Table 2. The yield attributes *viz.*, mean pod length, pod width, pod weight, no. of seeds per pod, pod yield per plant and pod yield per hectare were recorded as per standard procedures in vogue. The data was analyzed statistically using *F*-test following Gomez and Gomez (1984). LSD values at $p<0.05$ were used to determine the significance of difference between treatment means.

3. Results and Discussion

The present study indicated that there exists wide variation in vegetative characters (stem pigmentation, leaf colour and leaf shape), floral characters (days to 50% flowering, standard petal, wing petal and keel petal colour), yield attributes (mean pod length, pod width, pod weight, no. of seeds pod^{-1}) and yield among bean genotypes.

Out of the 45 genotypes observed for vegetative characters, the stem pigmentation was almost solid in only two genotypes (IC-426968 & IC-427428), extensive in six genotypes (ADP10, IC-384066, IC-427423, USRAM-01-209, IC-427429 and RND-1), localized to nodes in four genotypes (IC-598467, 1, IC-426974 and IC-426950) and no stem pigmentation in 33 genotypes. The leaf colour was green in 12 genotypes and dark green in 33 genotypes. The leaf shape was round in case of IC-426968, lanceolate in RDG-3/IC-26131 and ADP-4, ovate lanceolate in 10 genotypes (ADP-1, ADP-3, ADP-5, ADP-13, ADP-14, USRAM-01-209, IC-426975, IC-446564, RND-1, and 3) and ovate in the rest of the 32 genotypes (Table 3).

Of all the genotypes tested ADP-11 was earliest, which took only 115 days to 50% flowering, Sambram was late (133 days). The standard petal colour was cream in case of USRAM-01-209, purple in case of IC-426950, IC-426974, IC-427429 and 1, pink in case of five genotypes (ADP-10, IC-426968, IC-427462, IC-427436 and RND-1) and white in rest of the thirty five genotypes. The wing petal was cream in case of USRAM-01-209, purple in case of IC-426974, pink in eight genotypes and white in thirty five genotypes. The keel petal was cream in case of USRAM-01-209, light yellow in case of IC-426950, pink in case of ADP-10 and1, purple in case of IC-426968, IC-427429, IC-427436, IC-427462 and RND-1 and white in case of the rest of the thirty six genotypes (Table 3).

A pooled mean analysis of two years data on yield attributes and yield of forty five bean genotypes revealed significant variation in pod length (7.68 to 16.15 cm), pod width (3.41 to

Table 2: Plant data based descriptors of Dolichos bean (*Dolichos lablab* L.)

	Descriptor	Descriptor state/scale
I. Vegetative		
1.	Stem Pigmentation	0= no pigmentation, 3= localized to nodes, 5= extensive, 7= almost solid
2.	Leaf colour	1=pale green, 3=green, 5=dark green, 7=purple, 9=dark purple
3.	Leaf shape	1=round, 3=ovate, 5=ovate lanceolate, 7= lanceolate, 9= linear lanceolate
II. Inflorescence		
1.	Days to 50% flowering	Days from sowing to 50% of the plants produce flower
2.	Flower bud colour	1=white, 2=cream, 3=light yellow, 4=pink, 5=purple
3.	Standard petal colour	1=white, 2=cream, 3=light yellow, 4=pink, 5=purple
4.	Wing petal colour	1=white, 2=cream, 3=light yellow, 4=pink, 5=purple
5.	Keel petal colour	1=white, 2=cream, 3=light yellow, 4=pink, 5=purple

Table 3: Performance of *Dolichos* bean germplasm for qualitative vegetative and inflorescence characters at HRS, Adilabad (Northern Telangana Zone)

Genotype	Stem pigmentation	Leaf colour	Leaf shape	Days to 50% flowering	Standard petal colour	Wing petal colour	Keel petal colour
ADP-1	(0) No pigmentation	(5) Dark green	(5) Ovate Lanceolate	125.3	(1) White	(1) White	(1) White
ADP-2	(0) No pigmentation	(3) Green	(3) Ovate	130.0	(1) White	(1) White	(1) White
ADP-3	(0) No pigmentation	(5) Dark green	(5) Ovate Lanceolate	129.0	(1) White	(1) White	(1) White
ADP-4	(0) No pigmentation	(5) Dark green	(7) Lanceolate	131.3	(1) White	(1) White	(1) White
ADP-5	(0) No pigmentation	(5) Dark green	(5) Ovate Lanceolate	127.7	(1) White	(1) White	(1) White
ADP-6	(0) No pigmentation	(3) Green	(3) Ovate	125.7	(1) White	(1) White	(1) White
ADP-7	(0) No pigmentation	(3) Green	(3) Ovate	123.3	(1) White	(1) White	(1) White
ADP-8	(0) No pigmentation	(5) Dark green	(3) Ovate	119.3	(1) White	(1) White	(1) White
ADP-9	(0) No pigmentation	(5) Dark green	(3) Ovate	121.0	(1) White	(1) White	(1) White
ADP-10	(5) Extensive	(5) Dark green	(3) Ovate	126.7	(4) Pink	(4) Pink	(4) Pink
ADP-11	(0) No pigmentation	(5) Dark green	(3) Ovate	115.0	(1) White	(1) White	(1) White
ADP-12	(0) No pigmentation	(3) Green	(3) Ovate	126.3	(1) White	(1) White	(1) White
ADP-13	(0) No pigmentation	(3) Green	(5) Ovate Lanceolate	121.3	(1) White	(1) White	(1) White
ADP-14	(0) No pigmentation	(5) Dark green	(5) Ovate Lanceolate	125.7	(1) White	(1) White	(1) White
RDG-26	(0) No pigmentation	(5) Dark green	(3) Ovate	130.0	(1) White	(1) White	(1) White
RDG-14	(0) No pigmentation	(5) Dark green	(3) Ovate	126.0	(1) White	(1) White	(1) White
Sambhram	(0) No pigmentation	(5) Dark green	(3) Ovate	133.0	(1) White	(1) White	(1) White
PSRJ-12953	(0) No pigmentation	(3) Green	(3) Ovate	125.7	(1) White	(1) White	(1) White
IC-426950	(3) localized to nodes	(3) Green	(3) Ovate	127.3	(5) Purple	(4) Pink	(3) Light yellow
IC-426974	(3) localized to nodes	(5) Dark green	(3) Ovate	121.0	(5) Purple	(5) Purple	(1) White
IC-384066	(5) Extensive	(3) Green	(3) Ovate	126.0	(1) White	(1) White	(1) White
IC-598467	(3) localized to nodes	(5) Dark green	(3) Ovate	123.0	(1) White	(1) White	(1) White
IC-427424	(0) No pigmentation	(5) Dark green	(3) Ovate	128.0	(1) White	(1) White	(1) White
IC-427423	(5) Extensive	(5) Dark green	(3) Ovate	119.0	(1) White	(1) White	(1) White
IC-427416	(0) No pigmentation	(3) Green	(3) Ovate	122.0	(1) White	(1) White	(1) White
IC-426968	(7) Almost solid	(5) Dark green	(1) Round	118.3	(4) Pink	(4) Pink	(5) Purple
US-RAM-01-209	(5) Extensive	(5) Dark green	(5) Ovate lanceolate	127.7	(2) Cream	(2) Cream	(2) Cream
IC-426975	(0) No pigmentation	(3) Green	(5) Ovate lanceolate	129.0	(1) White	(1) White	(1) White
IC-426988	(0) No pigmentation	(5) Dark green	(3) Ovate	124.3	(1) White	(1) White	(1) White
IC-446583	(0) No pigmentation	(3) Green	(3) Ovate	128.7	(1) White	(1) White	(1) White
IC-427437	(0) No pigmentation	(5) Dark green	(3) Ovate	128.0	(1) White	(1) White	(1) White
IC-427429	(5) Extensive	(5) Dark green	(3) Ovate	130.0	(5) Purple	(4) Pink	(5) Purple
IC-546388	(0) No pigmentation	(5) Dark green	(3) Ovate	124.0	(1) White	(1) White	(1) White
IC-446591	(0) No pigmentation	(5) Dark green	(3) Ovate	132.0	(1) White	(1) White	(1) White
IC-446580	(0) No pigmentation	(5) Dark green	(3) Ovate	123.3	(1) White	(1) White	(1) White
IC-446564	(0) No pigmentation	(5) Dark green	(5) Ovate Lanceolate	129.7	(1) White	(1) White	(1) White

Table 3: Continue...

Genotype	Stem pigmentation	Leaf colour	Leaf shape	Days to 50% flowering	Standard petal colour	Wing petal colour	Keel petal colour
IC-427462	(0) No pigmentation	(5) Dark green	(3) Ovate	126.7	(4) Pink	(4) Pink	(5) Purple
IC-427428	(7) Almost solid	(5) Dark green	(3) Ovate	129.0	(1) White	(1) White	(1) White
IC-427436	(0) No pigmentation	(3) Green	(3) Ovate	125.0	(4) Pink	(4) Pink	(5) Purple
RND-1	(5) Extensive	(5) Dark green	(5) Ovate lanceolate	126.0	(4) Pink	(4) Pink	(5) Purple
NSJ-398/ RDG-33	(0) No pigmentation	(5) Dark green	(3) Ovate	131.7	(1) White	(1) White	(1) White
RDG-3/IC-26131	(0) No pigmentation	(5) Dark green	(7) Lanceolate	124.0	(1) White	(1) White	(1) White
1	(3) localized to nodes	(5) Dark green	(3) Ovate	123.0	(5) Purple	(4) Pink	(4) Pink
2	(0) No pigmentation	(5) Dark green	(3) Ovate	128.0	(1) White	(1) White	(1) White
3	(0) No pigmentation	(5) Dark green	(5) Ovate lanceolate	122.7	(1) White	(1) White	(1) White

6.36 cm), pod weight (3.08 to 11.05 g), seeds pod^{-1} (3.63-6.35) and pod yield plant^{-1} (340-2713 g).

Significantly higher mean pod length was recorded by IC-427436 and IC-427462 (16.15 cm) over rest of the genotypes and was at par with IC-427424 and IC-427423 and the lowest mean pod length was recorded with 2. Mean pod length was more than 10 cm in 27 genotypes, more than 12 cm in 11 genotypes (ADP-7, ADP-10, Sambhram, IC-384066, IC-427424, IC-427423, IC-427416, IC-426968, IC-446564, IC-427462, IC-427436, RND-1 and RDG-33).

Significantly higher mean pod width was recorded with genotype PSRJ-12953 (6.36 cm) but was at par with IC-384066, IC-446564, IC-427423, IC-427429, IC-427424, IC-427462, IC-426950, IC-427436, IC-598467, ADP-5 and ADP-7. The lowest mean pod width was reported by ADP-6 (3.41 cm). Thirteen genotypes had a pod width of more than 5 cm (ADP-7, PSRJ-12953, IC-426950, IC-384066, IC-59867, IC427424, IC-427423, IC-426975, IC-426988, IC-427429, IC-446564, IC-427462 and IC-427436).

IC-427436 recorded significantly superior mean pod weight (11.05 g) over rest of the genotypes but was at par with IC-427462, IC-446564, IC-427424 and IC-384066. Out of the 45 genotypes four genotypes had recorded more than 10 g mean pod weight (IC-427424, IC-446564, IC-427462 and IC-427436).

The number of seeds pod^{-1} was highest with the genotype Sambram (6.35) but was at par with IC-427436 and IC-427462. Fifteen genotypes recorded more than 5 seeds per pod (ADP-6, ADP-10, ADP-12, ADP-13, Sambhram, IC-426974, IC-384066, IC-427423, IC-426968, IC-427437, IC-446580, IC-427462, IC-427436, RND-1 and RDG-3/IC-26131).

Genotype IC-427436 recorded significantly higher pod yield per plant (2713 g) and pod yield ha^{-1} (13563 kg) over rest of the genotypes and it was followed by the genotypes IC-427462 and RND-1. Among the 45 genotypes ten genotypes (ADP-2, RDG-26, IC-546388, IC-446580, IC-446564, IC-427462, IC-427436, RND-1, 1 and 3) have recorded more than 1000 g plant^{-1} and 5 t ha^{-1} pod yield (Table 4).

Table 4: Yield attributes and yields of dolichos bean genotypes at HRS, Adilabad (NTZ)

Treatment	Pooled mean data of 2018 and 2019					
	Mean pod length (cm)	Mean pod width (cm)	Mean pod weight (g)	No. of seeds pod^{-1}	Pod yield plant^{-1} (g)	Pod yield ha^{-1} (kg)
ADP-1	8.10	3.75	4.01	4.60	997	4985
ADP-2	8.41	3.77	5.29	4.73	1128	5638
ADP-3	7.69	4.50	4.96	4.65	521	2605
ADP-4	9.25	4.70	5.19	4.40	554	2768
ADP-5	9.43	5.46	5.88	4.83	770	3849
ADP-6	9.59	3.41	4.78	5.10	717	3583
ADP-7	12.72	5.45	8.32	4.63	821	4101
ADP-8	11.37	3.72	6.89	4.10	765	3823
ADP-9	8.04	3.61	4.15	4.53	666	3327

Table 4: Continue...

Treatment	Pooled mean data of 2018 and 2019					
	Mean pod length (cm)	Mean pod width (cm)	Mean pod weight (g)	No. of seeds pod^{-1}	Pod yield plant^{-1} (g)	Pod yield ha^{-1} (kg)
ADP-10	13.70	4.37	6.58	5.08	499	2497
ADP-11	10.03	4.42	7.16	4.80	680	3397
ADP-12	9.32	4.27	4.77	5.83	421	2104
ADP-13	9.88	4.15	4.07	5.50	507	2531
ADP-14	11.42	4.76	7.29	5.00	466	2329
RDG-26	8.27	4.35	4.60	3.63	1062	5311
RDG-14	9.93	4.32	4.20	4.40	340	1701
Sambhram	12.46	4.01	5.81	6.35	499	2496
PSRJ-12953	9.07	6.36	5.89	4.13	344	1716
IC-426950	10.69	5.52	7.49	3.98	808	4037
IC-426974	10.64	4.93	6.50	5.03	674	3368
IC-384066	12.53	6.10	9.58	5.08	514	2570
IC-598467	11.86	5.47	6.55	4.80	583	2910
IC-427424	14.84	5.75	10.58	4.85	690	3448
IC-427423	14.58	5.80	9.04	5.30	463	2312
IC-427416	14.03	4.68	8.10	4.95	879	4809
IC-426968	12.50	4.97	7.96	5.15	864	4320
USRAM-01-209	11.84	3.47	6.37	4.83	649	3241
IC-426975	10.79	5.27	6.88	4.35	599	2993
IC-426988	9.43	5.33	5.25	3.73	503	2511
IC-446583	9.83	4.38	5.86	4.35	434	2167
IC-427437	10.38	4.68	7.56	5.08	510	2547
IC-427429	11.77	5.75	8.50	3.80	690	3450
IC-546388	9.52	4.53	6.95	4.60	1221	6101
IC-446591	9.94	4.14	5.64	4.98	583	2915
IC-446580	11.30	3.74	5.23	5.20	1170	5850
IC-446564	14.15	5.92	10.60	4.90	1310	6547
IC-427462	16.15	5.63	10.70	6.20	1986	9930
IC-427428	11.99	4.77	7.06	3.53	652	3257
IC-427436	16.15	5.49	11.05	6.33	2713	13563
RND-1	13.88	3.56	5.86	5.50	1464	7316
NSJ-398/RDG-33	14.16	4.00	6.39	4.90	698	3490
RDG-3/IC-26131	10.18	3.74	5.00	5.08	570	2848
1	10.63	4.15	4.64	3.80	1118	5587
2	7.68	4.04	3.08	4.40	652	3262
3	9.71	4.00	5.24	4.58	1360	6797
SEm±	0.61	0.32	0.58	0.09	137	699
CD (p=0.05)	1.75	0.93	1.65	0.24	391	1998

The higher plant yield in case of IC-427436 might be due to improved yield attributes (higher pod length, higher mean pod weight and more number of seeds pod^{-1}) which is in conformity with the studies of Singh et al. (2004), Upadhyay and Mehta (2010) and Singh et al. (2000). Similar opinion was also given by Gnanesh et al., 2006 in faba bean.

4. Conclusion

Genotype IC-427436 with no stem pigmentation, green and ovate leaves, pink colour standard and wing petal, purple colour keel petal has recorded a mean pod length of 16.15 cm, pod width of 5.49 cm, pod weight of 11.05 g, number of seeds per pod 6.33, highest pod yield plant^{-1} (2713 g) and per hectare (13563 kg). It was followed by the genotype IC-427462 with a pod yield plant^{-1} and ha^{-1} (1986 g and 9930 kg) and RND-1(1464 g and 7316 kg).

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