

Doi: [HTTPS://DOI.ORG/10.23910/IJEP/2018.5.2.0242](https://doi.org/10.23910/IJEP/2018.5.2.0242)

Agronomic Performance for Tuber Characters in Winged Bean [*Psophocarpus tetragonolobus* (L.) DC.]

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Article History

Article ID: IJEP0242
Received in 27th January, 2018
Received in revised form 7th March, 2018
Accepted in final form 18th March, 2018

Abstract

The present investigation was carried out to identify the tuber producing genotypes from a pool of 27 genotypes of winged bean. The experiments were conducted at Vegetable Research Farm of Banaras Hindu University, Varanasi, Uttar Pradesh during *kharif* season of 2014 and 2015. Among 27 genotypes, 22 genotypes were tuberous roots producing, while rest five genotypes were non-tuberous. These tubers forming 22 genotypes were further grown for evaluation of their performance in next *kharif* season of 2015. Based on different agronomic characters, the accessions RWB-15 recorded the highest values for tuber yield plant⁻¹ (g), tuber length (cm), tuber dry matter (%) and total sugar content (g g⁻¹) in tuber with moderate values for tuber breadth (cm), 100 seeds weight (g) and tuber crude protein (%), followed by Ambika-13-4, RMDWB-1, Ambika WB -11-2 and IC-178292 which appeared promising for different tuber characters. Therefore, RWB-15 along with the above four accessions could be tested under different agronomic practices for commercial production and human consumption of this tuber producing legume.

Keywords: Winged bean, genotypes, tuberous roots, tuber yield

1. Introduction

Winged bean [*Psophocarpus tetragonolobus* (L.) DC.] is an under-utilized plant which has a wide genetic potential, to be utilized as a source of quality food and forage. Winged bean is a protein rich multipurpose legume. It is consumed as pods, seeds, flowers and also tuberous roots because of their great nutritional values. Winged bean has been regarded as “One species supermarket” because practically all of the plant parts are edible (Bhattacharyya, 2016; Wilson et al., 2006; Wilson, 1984). The tubers, young pods, seeds, leaves, flowers and shoot are rich in protein, amino acids, oils, vitamins and minerals (Claydon, 1978; Hettiarachchy and Kantha, 1982).

An interesting feature of the winged bean is that it produces tuberous roots. Its tubers contain high crude protein as well as carbohydrate (on dry basis) of 3-15% and 27.2-30.5%, respectively (Burkill, 1906; NAS, 1981; Chandel, 1984). The tubers are said to have a pleasant and slightly sweet taste, ivory white flesh and firm texture resembling an apple (NAS, 1975a; 1975b). Tuber development is a genetic character and is fully attained at ten to twelve months of growth (Karikari, 1978). Non-availability of suitable tuber producing genotypes and narrow genetic base in winged bean restrict its growing

on limited parts of the world.

In humid sub-tropical parts of north-eastern region of India i.e. Tripura, Manipur, Mizoram including adjoining areas of Assam and sporadic occurrence in the Western Ghats, winged bean only known for their green pods and seeds.

Studies on genetics and breeding of winged bean are limited. Hitherto, the genetic diversity of the crop remains largely unexploited. Winged bean received no appreciable research effort, especially for its genetic improvement. Therefore, realizing the importance and need of this underexploited grain legume, experiments were conducted for evaluation of performance of some germplasm for tuber characters.

2. Materials and Methods

The present investigation was carried out at Vegetable Research Farm of Banaras Hindu University, Varanasi, Uttar Pradesh during *kharif* season of 2014 and 2015. During *kharif* 2014 season, 27 diverse winged bean genotypes were grown for judging their potential for tuber growth.

Based on observations 22 genotypes with tuberous growth out of 27 were selected for evaluation in *kharif* season of 2015. All selected 22 genotypes were grown in a Randomized



block design with three replications during *kharif* season 2015. Each plot consisted of one row of 5 m length with row to row and plant to plant distance of 75 cm and 50 cm, respectively. Plants were subjected to vegetative pruning and reproductive pruning to promote good tuber growth. Tuber harvesting was done, when the all plant parts dried up to around 80%.

Crude protein (%), total sugar Content (g g^{-1}) and Dry Matter (%) in tuber were estimated by using Micro- Kjeldahl, Anthrone and AOAC methods, respectively.

Observations were recorded on five pruned plants for Tuber yield plant^{-1} (g), Tuber length (cm.), Tuber breadth (cm.), Tuber dry matter (%), Tuber crude protein (%), Total sugar content in tuber (g g^{-1}) and 100 seed weight (g).

3. Results and Discussion

Among 27 genotypes, only 22 genotypes were tuber producing, while rest five genotypes were non-tuberous (Table 1).

The result of 22 winged bean genotypes showed the range of mean from 12.95 cm. in EC-15018 to 18.89 cm. in RWB-15 with general mean 15.88 cm. for tuber length, 0.59 cm. in Ambika WB -13-1 to 1.55 cm. in Ambika-13-4 with general mean 1.13 cm. for tuber breadth, 20.19% in RWB-13 to 35.89 % in RWB-15 with general mean 27.90% for tuber dry matter %, 0.280 g g^{-1} in RWB-13 to 0.518 g g^{-1} in RWB-15 with general mean 0.379 g g^{-1} for total sugar content in tuber, 5.05% in Ambika WB-13-1 to 7.26% in IC-26904 with general mean 6.20% for tuber crude protein %, 18.19 g in RMDWB-1 to 37.19 g in IC-38683 with general mean 25.76 g for 100 seed weight, 12.65 g in EC-178309 to 47.95 g in RWB-15 with general mean 25.45 g for tuber yield plant^{-1} .

The upper limit of range for various traits under study was exhibited by different accessions. However, accessions exhibiting highest values for more than one characters are RWB-15 for tuber yield plant^{-1} (47.95 g), tuber length (18.89 cm), tuber dry matter (35.89%), total sugar content in tuber (0.52 g g^{-1}) with moderate values for tuber breadth (1.30

Table 1: Tuberous (22) and non-tuberous (5) root genotypes of winged bean

Tuberous root genotypes				Non-tuberous root genotypes
RWB-15	Ambika-13-4	RMDWB-1	Ambika WB-11-2	Ambika WB-11-2 (white)
IC-178292	IC-26904	AKWB-1	IC-38683	EC-172600
Ambika WB 11-1	Ambika-13-5	Ambika WB-13-6	EC-15018	EC-178279
EC-13084	BHW-1	Ambika WB-11-3	RWB-2	EC-178295
RWB-16	EC-178289	Ambika WB-13-1	EC-27884	IC-26945
RWB-13	EC-178309			

cm), 100 seed weight (25.68 g) and tuber crude protein (5.63 %), followed by Ambika-13-4, RMDWB-1, Ambika WB -11-2 and IC-178292 which appeared promising for different tuber characters (Table 2).

The accessions RWB- 15 recorded highest mean performance for tuber yield plant^{-1} followed by Ambika-13-4, RMDWB-1, Ambika WB-11-2 and IC-178292 (Figure 1). Mohamad et al. (2005) also reported high tuber yield of winged bean.

Table 2: Range and Mean performance of different characters in 22 tuber producing genotypes in winged bean

S I . No.	Characters Genotypes	Tuber length (cm)	Tuber breadth (cm)	Tuber dry matter %	Total sugar content (g g^{-1}) in tuber	Tuber crude protein %	100 seed weight (g)	Tuber yield plant^{-1} (g)
1.	RWB-15	18.89	1.30	35.89	0.518	5.63	25.68	47.96
2.	Ambika -13-4	16.01	1.55	27.00	0.320	5.74	24.00	40.13
3.	RMDWB-1	18.37	1.28	34.04	0.490	5.36	18.19	35.54
4.	Ambika WB-11-2	17.72	1.01	29.87	0.461	6.32	26.04	34.80
5.	IC-178292	16.19	1.30	30.37	0.483	5.75	22.42	34.15
6.	IC-26904	15.86	0.90	28.52	0.444	7.26	23.67	31.48
7.	AKWB-1	16.79	1.37	31.61	0.350	6.30	25.07	30.54
8.	IC-38683	15.86	1.28	27.96	0.371	5.82	37.19	26.78
9.	Ambika WB-11-1	15.82	0.87	27.47	0.406	6.71	27.80	25.22
10.	Ambika -13-5	14.91	1.19	22.53	0.355	5.72	29.33	23.83
11.	Ambika WB-13-6	14.84	1.08	30.86	0.328	6.06	35.67	23.49

Continue...



Sl. No.	Characters Genotypes	Tuber length (cm)	Tuber breadth (cm)	Tuber dry matter %	Total sugar content (g g ⁻¹) in tuber	Tuber crude protein %	100 seed weight (g)	Tuber yield plant ⁻¹ (g)
12.	EC-15018	12.95	1.31	28.28	0.483	6.12	26.00	23.46
13.	EC-13084	14.71	1.28	22.53	0.386	6.08	19.00	22.57
14.	BHW-1	16.05	1.14	33.15	0.335	6.40	22.38	21.33
15.	Ambika WB-11-3	15.87	1.09	24.87	0.355	7.05	25.19	20.50
16.	RWB-2	17.83	1.12	30.74	0.287	6.09	22.00	20.47
17.	RWB-16	15.69	1.30	24.38	0.320	7.12	25.33	17.95
18.	EC-178289	16.65	1.02	24.05	0.304	6.74	27.37	17.81
19.	Ambika WB-13-1	16.75	0.59	28.79	0.344	5.05	22.67	17.64
20.	EC-27884	14.62	0.99	30.04	0.354	6.16	24.67	16.22
21.	RWB-13	13.68	1.05	20.19	0.280	6.66	28.33	15.46
22.	EC-178309	13.38	0.75	20.70	0.361	6.28	28.73	12.65
Range	Minimum	12.95	0.59	20.19	0.280	5.05	18.19	12.65
	Maximum	18.89	1.55	35.89	0.518	7.26	37.19	47.95
General mean		15.88	1.13	27.90	0.379	6.20	25.76	25.45

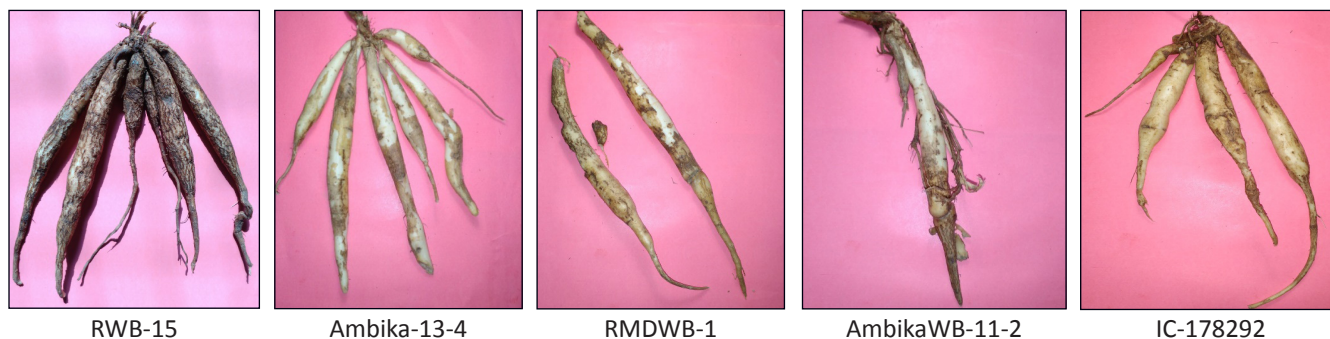


Figure 1: Top five high tuber yielding genotypes of winged bean

4. Conclusion

The winged bean genotypes showed a wide range of variation for tuber yield plant⁻¹ followed by others remaining characters studied. The results indicate that there is ample scope for selection of promising genotypes from present set of accessions for tuber yield improvement programme. The variability in this germplasm pool could be utilized in recombination breeding programme for accumulation of desirable traits in a single genotype.

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