



Evaluation on Growth and Yield Attributes of Ten Winged Bean Accessions in the Guinea Savannah Zone of North Central Nigeria

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ABSTRACT

Field experiment was conducted at the Biotechnology Advanced Research Centre Farm, Garki-Abuja during 2018 and 2019 cropping seasons to evaluate ten accessions of winged bean. The experiment was laid out using Randomized Complete Block Design (RCBD), replicated three times, respectively. Data collected on growth and yield parameters were number of leaves per plant, vine length per plant, number of flowers per plant, pod length per plant, number of seeds per plot, seed weight per plot and seed yield. These were subjected to analysis of variance (ANOVA) and significant means compared using Duncan Multiple Range Test (DMRT). Results obtained revealed that the growth parameters of the plants increased as the plant aged. The highest vine length was obtained from TPT 9 (102.77 cm) accession and least mean values were observed from TPT 30, TPT 33 and TPT 3 in ascending order (80.57cm, 81.43 cm and 81.73 cm). There was significant ($p \leq 0.05$) difference in seed yield among the accessions with the highest yield obtained from TPT 48 (4.54 t/ha) while the least mean value was gotten from TPT 19 (2.59 t/ha). From this study, it could be deduced that for optimum yield

performance TPT 48 thrived better than other accessions and can therefore be adopted by farmers in this ecological zone.

INTRODUCTION

Winged bean [*Psophocarpus tetragonolobus* (L.) DC] is an herbaceous perennial plant but can be grown as an annual crop (Anamika *et al.*, 2011). It is an underutilized plant which has a wide genetical potential to be utilized as a source of quality food and forage (Sayyidah *et al.*, 2021). It is also a protein rich multipurpose legume and is listed as one of the under exploited plant in the tropics (Amoo *et al.*, 2006) with huge potential as a food source (Mahto and Dua, 2009; Amoo, 1998). It is consumed as pods, seeds, flowers and also tuberous roots because of their great nutritional values. 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). Winged bean has been regarded as “one species supermarket” because practically all of the plant parts are edible (Bhattacharyya, 2016; Wilson, 1984, Ali *et al.*, 2005). At maturity, the pods are 6-9 inches long and 1½ inches broad, with four angled leaflike wings running lengthwise to the pods. Seeds are round and green when mature, similar to soybeans. Root and seed are high in protein. Much publicity has been given to this because of its high protein content and the edibility of so many parts. Winged bean plants grow best under hot, wet conditions and grow best with 60 to 100 inches of rainfall or irrigation per year. Winged bean can be grown in a range of soils as long as it has good drainage. The soil is worked in with well rotted compost and 8-8-8 NPK fertilizer before planting. The plant can fix its own nitrogen if the Rhizobium bacteria are present in the soil (Anon, 2018). This research aimed at identifying 10 winged bean accessions that can adapt and perform better in terms of growth and yield in the Guinea Savannah Zone of north central Nigeria.

MATERIALS AND METHODS

Field experiment was conducted at the Biotechnology Advanced Research Centre Farm, Sheda Science and Technology Complex Garki-Abuja, FCT, Nigeria in 2018 and 2019 cropping seasons to evaluate ten winged bean accessions. Abuja is located at 8°10'N and 7° 10'N and the climate is cold and dry from November to March and then warm and moist from April to October. The maximum and minimum temperature is 35 and 27°C, respectively. The humidity of this area is high (74%) all the year round except in January when dry wind blows from the north. The average annual rainfall is over 1250 mm. The soil is of a sandy loam texture, moderately well drained and was previously under maize cultivation before fallowing for one cropping season. The seeds were sourced from the International Institute of Tropical Agriculture, Ibadan Oyo State, Nigeria. The ten winged bean accessions used were: TPT 3, TPT 6, TPT 9, TPT19, TPT 30, TPT 32, TPT 33, TPT 42, TPT 48 and TPT 153. The treatments were laid out in a Randomized Complete Block Design (RCBD), replicated three times. Each plot consisted of four ridges at 50 cm wide and was separated 100 cm wide. The land was cleared, raked and ridged manually. The first planting was done between June and October 2018 and the second year planting was done in the same months in 2019. Two seeds were planted per hole at 50 cm within row and the seedlings were thinned to one per stand four weeks after emergence. Staking was done when the plants reached the twining stage by supporting with 3 m long dried sticks stake for access to adequate sunlight. Weeding was done with hoe four times at 3, 6, 9 and 12 weeks after planting (WAP). Placement method of fertilizer application was done at 150 kg N ha⁻¹ to boost plant growth. Data collected on growth and yield parameters were number of leaves per plant, vine length per plant, number of flowers per plant, pod length per plant, number of seeds per

plot, seed weight per plot and seed yield. Data means were subjected to analysis of variance (ANOVA) using MSTAT package and significant means were separated by Duncan Multiple Range Test (DMRT) at 5% probability level.

RESULTS AND DISCUSSION

Number of leaves: The number of leaves of ten winged bean accessions were not significantly ($p \geq 0.05$) different from each other at 3 and 9 WAP in 2018 and 2019 cropping seasons, but was significant ($p \leq 0.05$) at 6 WAP in 2019 cropping season (Table 1). In 2019 cropping season, TPT 9 (59.60) and TPT 6(57.37) accessions produced the highest number of leaves while these two accessions were at par with each other. This was followed by TPT 33 (53.87) and the least mean value was observed from TPT 48 (936.10). Results from this study agreed with Sayyidah *et al* (2021) who emphasised that difference in genotypes could cause variation in the number of leaves formation in winged bean.

Vine length: The vine length varied significantly ($p \leq 0.05$) at 3, 6 and 9 WAP as shown in (Table 2). In 2018 cropping season, vine length of winged bean plants were significantly ($p \leq 0.05$) different at 3 and 9 WAP. Under 3 WAP, the optimum vine length was obtained in TPT 9 (9.17 cm) and TPT 153 (9.20 cm). This was closely followed by TPT 48 (8.77 cm) and the least mean value was obtained from TPT 3 (7.60 cm) accession. Morealso, in 2018 cropping season at sampling occasion of 9 WAP; TPT 9 significantly ($p \leq 0.05$) proved its superiority over other accessions with mean value (102.77 cm). This was followed by TPT 153 (94.20 cm) while the least mean values were obtained from TPT 30, TPT 33 and TPT 3 in this ascending order (80.57cm, 81.43 cm and 81.73 cm). This indicated that the accessions exhibited significant variations on the vine length per plant. Result obtained in this study corroborates with Adegboyega *et al* (2021) who stated that significant variations were observed among the accessions on some growth parameters during their study.

Number of flowers: The number of flowers were significantly ($p \leq 0.05$) different from each other only in 2018 cropping season. Plants of TPT 9 (10.27) recorded the highest number of flowers but were at par with TPT 153 (9.20). This was followed by TPT 33 (9.17) while the least mean values were observed from TPT 3, TPT 19 and TPT 6, respectively (Table 3). The result obtained from this study is in agreement with Lawal *et al* (2019) who reported that accessions exhibited significant ($p \leq 0.05$) variation for flowering and podding dates, petiole length and top leaflet length. The flowering variations may be due to the plants genetic makeup.

Pod length: The pod length of the ten winged bean accessions evaluated were not significantly ($p \geq 0.05$) different from each other in 2018 and 2019 cropping seasons. However, the longest pod length was obtained from TPT 33 (17.40 cm) in 2019 cropping season, while the least mean value was gotten from TPT 48 in 2018 cropping season (Table 3).

Number of seeds: The mean number of seeds of ten winged bean accessions were not significantly ($p \geq 0.05$) different in both cropping seasons. Evidently, it became clear that despite non-significance effect recorded among the accessions, the highest mean value was obtained from TPT 42 (169.67) in 2019 cropping season and the least mean value was observed from TPT 19 (33.93) in 2018 cropping season (Table 4). However, research conducted by Lawal *et al* (2019) showed that number of seeds per pod varied from 7 to 15 seeds per pod among the

accessions with a mean of 12.5 seeds per pod. The non-significance effect on the number of seeds per pod obtained from this study may be due to edaphic and environmental condition.

Seed weight: The winged bean accessions had significant ($p \leq 0.05$) effect on each other in 2019 cropping season. The accessions evaluated proved their superiority with the heaviest mean value obtained from TPT 48 (113.43 g) which was followed by TPT153 (98.33 g) and the least mean value was observed from TPT 19 (64.63 g). Seed weight is a function of seeds formed in the pods. According to (Kumaga *et al.* 2003, Anon. 2011) early flower formation can increase seeds in the pod. They also opined that early flowering in grain legumes could lead to reduction in flower abortion thereby increasing the number of seeds and weight.

Seed yield: The winged bean accessions were significantly ($p \leq 0.05$) different from each other only in 2019 cropping season with the highest mean value recorded from TPT 48 (4.54 t/ha). This was closely followed by TPT 153 (4.22 t/ha) while the least mean value was gotten from TPT 19 (2.59 t/ha). The highest grain yield obtained from this study is lower than 7.28 t/ ha reported by Mohammad *et al* (2016). This could be as a result of genetic and environmental factor.

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Table 1. The mean number of leaves of ten winged beans accessions in 2018 and 2019 cropping season

Accessions	3WAP		6WAP		9WAP	
	Number of leaves					
	2018	2019	2018	2019	2018	2019
TPT3	18.03	17.40	21.37	50.99abc	23.53	328.00
TPT6	17.83	17.60	20.83	57.37a	22.87	323.33
TPT9	18.80	16.67	21.67	59.60a	24.30	258.00
TPT19	18.27	17.90	21.20	49.03abc	24.03	341.67
TPT30	19.60	17.57	22.10	42.87bcd	24.43	461.67
TPT32	18.37	19.00	21.33	50.13abc	23.77	275.33
TPT33	18.67	16.57	21.43	53.87ab	23.93	353.00
TPT42	18.47	18.27	21.20	40.67cd	24.10	245.00
TPT48	19.43	19.00	22.00	36.10d	24.60	284.67
TPT 135	18.87	19.07	21.87	48.37abc	24.77	307.33
CV(%)	6.7	12.7	4.4	12.0	3.1	49.5

Means with the same letter in the same column are not significantly different using Duncan Multiple Ratio (DMRT) at 5% probability level

Table 2. The mean vine length of ten winged bean accessions in 2018 and 2019 cropping season

Accessions	Vine length (cm)					
	3WAP		6WAP		9WAP	
	2018	2019	2018	2019	2018	2019
TPT 3	9.60c	64.43	32.43d	109.53	81.73c	248.27
TPT 6	8.57abc	74.77	34.97bcd	145.27	86.17bc	289.53
TPT 9	9.17a	63.67	39.27a	128.33	102.77a	251.77
TPT 19	8.53abc	60.70	35.00bcd	130.80	85.60bc	239.33
TPT 30	7.93bc	82.97	33.77cd	130.27	80.57c	299.60
TPT 32	8.27abc	60.90	36.20abc	152.43	85.70bc	249.77
TPT 33	8.53abc	58.27	35.53bcd	123.70	81.43c	230.67
TPT 42	8.37abcd	47.57	36.00bc	153.87	83.10bc	219.27
TPT 48	8.77ab	58.70	37.53ab	127.73	90.51bc	239.03
TPT 153	9.20a	54.23	37.63ab	139.53	94.20ab	291.47
CV(%)	6.3	32.4	4.6	18.4	7.0	14.7

Means with the same letter in the same column are not significantly different using Duncan Multiple Ratio (DMRT) at 5% probability level

Table 3. The mean number of flowers and pod length of ten winged bean accessions in 2018 and 2019 cropping seasons

Accessions	Number of flower/plant		Pod length /plant (cm)	
	2018	2019	2018	2019
TPT 3	8.10c	5.33	14.50	15.30
TPT 6	8.20c	7.00	15.03	14.87
TPT 9	10.27a	10.67	14.57	15.50
TPT 19	8.10c	9.33	14.97	15.10
TPT 30	8.60bc	6.33	13.93	13.93
TPT 32	8.60bc	10.17	14.29	14.73
TPT 33	9.17b	7.00	17.00	17.40
TPT 42	8.93bc	7.00	14.84	14.03
TPT 48	9.00bc	6.67	12.30	16.40
TPT 153	9.20a	6.67	13.81	15.03
CV(%)	5.4	43.5	12.2	12.4

Means with the same letter in the same column are not significantly different using Duncan Multiple Ratio (DMRT) at 5% probability level

Table 4. The mean number of seeds, seed weight and seed yield of ten winged bean accessions in 2018 and 2019 cropping season

Accessions	Number of seeds/plant		Seed weight (g)		Seed yield (t/ha)	
	2018	2019	2018	2019	2018	2019
TPT 3	41.27	43.50	80.89	73.50cd	3.17	2.94cd
TPT 6	39.97	65.00	81.78	76.60bcd	3.27	3.06cd
TPT 9	59.87	125.57	98.52	90.10bc	3.94	3.60bc
TPT 19	33.93	87.33	90.26	64.63d	3.61	2.59d
TPT 30	48.03	42.67	95.44	74.17cd	3.82	2.97cd
TPT 32	33.97	95.67	89.09	79.37bcd	3.59	3.18cd
TPT 33	40.60	62.67	91.55	85.43bcd	3.66	3.42bcd
TPT 42	43.10	169.67	98.13	83.27bcd	3.92	3.33bcd
TPT 48	46.50	86.33	107.43	113.43a	4.30	4.54a
TPT 153	51.43	95.33	112.99	98.33ab	4.52	4.22ab
CV(%)	33.9	79.2	16.6	14.6	16.9	14.9

Means with the same letter in the same column are not significantly different using Duncan Multiple Ratio (DMRT) at 5% probability level