KAU Mithra-Yard long bean variety promising for riverine alluvium of Central Travancore regions

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Abstract

Agricultural Research Station, Thiruvalla initiated an experiment during 2013 to evolve suitable yard long bean (YLB) variety for the riverine belts of Central Travancore region. Twelve accessions collected were continuously evaluated for their growth characters, yield traits and quality parameters. Among these, YLB 5 performed well in yield trials and farm trials. It recorded high green pod yield per hectare (20.72t/ha) with good shelf life and cooking quality. It has trailing growth habit with green stem and petiole. It also had attractive long light green pods having an average pod length of 78.60 cm. The accession was found to be promising and suitable for riverine alluvium of Upper Kuttanad region and therefore was released with the name 'KAU Mithra' by Kerala Agricultural University in 2018.

Keywords: Central Travancore, Pod yield, Upper Kuttanad, Yard long bean.

Introduction

The rivers Meenachil, Manimala, Pampa and Achencoil that flow through Central Travancore play a vital role in making the soil of the tract highly fertile. Riverine alluvium regions of Central Travancore region are suitable for vegetable cultivation especially vegetable cow pea. These areas are highly prone to floods and experience a short crop growing season from October-November to April-May. Yard long bean (*Vigna unguiculata* (L.) Walp. subsp. sesquipedalis (1) Verdcourt) is one of the major vegetable crops grown in riverine belts of Vembanad and elevated garden lands of Upper Kuttanad tracts. Commonly called as vegetable cowpea and its long immature pods have great demand in internal as well as external market. Yard long bean being a short duration vegetable with quick growth habit fits well to different cropping and farming systems prevalent in Central Travancore region. According to Fatokun et al.(2002) and Sanchez-Navarro et al. (2019), cowpea plays an important role in the cropping system of tropical and subtropical areas of the world. As the productivity of the vegetable per unit area is much higher than the cereals, cultivation of vegetable plays a vital role in the well-being and economy of the farming community of this region. As it is one of the favourite vegetables of Keralites, there is always a constant demand for yard long bean varieties and it is grown by farmers as main crop and intercrop. Cowpea forms a major component of the tropical farming systems because of its ability to improve marginal lands through nitrogen fixation (Sanginga et al., 2003).

Vegetable cowpea is a nutritive leguminous vegetable often termed as poor man's meat. It belongs to the family Fabaceae (Chromosome number 2n=2x=22) and originated from Central Africa. Long fleshy pods of vegetable cowpea are important source of dietary protein, vitamins, and

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minerals. Marketable pods contain 83.3% moisture, 3.5% protein, 2.0% fibre, 8.1 % carbohydrate, 0.09 % mineral matter, 0.5 % niacin and 14.0 mg Vitamin C /100 g of edible pods (Gopalakrishnan, 2007). According to Ano and Ubochi (2008), 100g of edible pods contain calcium (72.0 mg), phosphorus (59 mg), iron (2.5 mg), carotene (564 mg), thiamine (0.07 mg) and riboflavin (0.09 mg). Yard long bean is also rich in micronutrients as it contains 102.69 - 120.02 mg/ kg of iron, 32.58-36.66 mg/ kg of zinc, 2.92 - 3.34 mg/kg of manganese, and 0.33 - 0.57 mg kg^{-1} of cobalt (Ano and Ubochi, 2008). Besides a nutritive vegetable, it brings qualitative changes in soil by fixing nitrogen from atmosphere. The crop can fix about 240 $kgha^{-1}$ of atmospheric nitrogen and makes available 60-70 $kgha^{-1}$ nitrogen for succeeding crop. It can also be used for restoring soil fertility through biological nitrogen fixation as well as enrich the soil with its decaying residue after harvest (Ajay and Adesoye, 2013; Singh et al., 2002). By nitrogen fixation, it saves the cost of fertilizers and guarantees profitable yield Golob et al., 1996). Cowpea forms an important component of sustainable cropping system as it improves soil fertility of marginal lands and ensure good soil cover suppressing weeds (Inaizumi,1999).

Proper nutrient management is one of the major factors influencing the production and productivity of the crop. Vegetable varieties suitable to riverine ecosystem are needed for healthy and sustainable cultivation practices. Moreover, vegetable cowpea is a rich source of vegetable protein and it also ensures a stable income throughout the year for famers. Developing a variety which is responsive to integrated nutrient management will help the farmers to generate more income. According to Palada and Chang (2003), to identify the best varieties adapted to a particular location, the yield potential of currently grown varieties with that of other available varieties and accessions have to be compared. Considerable variability among cowpea genotypes was reported by several authors (Khanpara et al., 2015; Rambabu et al., 2016).

Considering the above facts, an experiment was conducted to identify the most ideal and promising YLB lines of vegetable cowpea suitable for the riverine alluvium of Central Travancore region that perform well under the existing recommended Integrated Nutrient Management conditions.

Materials and Methods

The experiment was conducted during the period from 2013 to 2017 at Agricultural Research Station, Thiruvalla, Pathanamthitta, Kerala. This location is at 9° 35' N latitude and 76° 56' E longitude. The trial was laid out in Randomized Block Design (RBD) with 3 replications. Standard cultivation practices as per the package of practices recommendations (KAU, 2011) under INM were adopted uniformly for all experimental plots. Collection and multiplication of the accessions were done during 2010 to 2012. Materials for the study consisted of 151 accessions gathered by conducting survey from different locations and collection from NBPGR, IIHR and KAU. After preliminary screening, 12 accessions were carried forward to Initial Evaluation Trial during 2013-14. Yield parameters were recorded at each harvest and pooled to get the final data. A variant observed in YLB 24 was selected and tagged as YLB 5. The average pod length of YLB 24 was 70.2 cm while that of YLB 5 was 78.4 cm.

During the first year, (IET 2013-14) evaluation of the collection of yard long bean under INM for yield and field level disease resistance to the major diseases like *Rhizoctonia* root rot, *Fusarium* wilt and *Colletotrichum* attack was noted. Based on the performance in IET, eight accessions were promoted to Comparative Yield Trial. CYT conducted during 2014-15 along with one popular variety from IIHR *viz.,* Arka Mangala, three popular varieties from KAU *viz.,* Vellayani Jyothika, Lola, Sharika, one accession from NBPGR (YLB 5) and three local collections *viz*., YLB 50, YLB82, and YLB 117. Second and Third CYTs were conducted during 2015-16. The accessions were continuously

evaluated for their growth and yield parameters *viz*., number of pods harvested per plant, pod weight (g), pod length (cm), yield of green pods per plant (kg) and yield (t ha^{-1}). Crop duration, pod colour, field reactions to biotic stress were also noted. Evaluations of sensory characteristics and organoleptic quality were done for measuring the consumer acceptability using 5-point hedonic scale by a selected panel of 10 judges. Shelf life was assessed by keeping the harvested green pods under normal room temperature and then the number of days up to which the pods remain fresh for consumption without loss of colour and glossiness were recorded.

Based on yield performance, pod length and shelf life, 4 accessions *viz.,* Lola, Arka Mangala, YLB - 5, YLB -117 were selected for on farm trials. Farm trials were conducted in 4 different locations in Pathanamthitta and Alappuzha districts during 2016-17 with NS 621 as check variety. The data on various quantitative and qualitative parameters were analyzed statistically applying the technique of analysis of variance as per Panse and Sukhatme, (1985).

Results and Discussion

The data pertaining to the performance of different vegetable cowpea accessions during Initial Evaluation Trial are given in Table 1. IET data revealed that accessions showed difference in several characters. Pod length varied from 42.3 cm to78.10 cm. Maximum pod length was recorded for YLB 5 while Sharika had small sized pods. Variation in flowering behaviour and pod length was reported earlier by Toppo et al. (2018). Pod weight varied from 17.33g (YLB 129) to 26.68 g (YLB 117). Sarada and Rao (2020) also reported difference in pod weight among accessions. Highest yield plant-1 was for YLB 117 (2.95 kg $plant^{-1}$) whereas YLB 126 recorded the lowest yield (1.77 kg $plant^{-1}$). These variations in yield are in line with the findings reported by Varghese and Celine (2015). Based on

Table 1. Data on the performance of yard long bean accessions in IET

Accession nos.	Yield/plant(kg)	Pod colour	Pod length (cm)	Pod weight (g)
Arka Mangala	2.90	Light green with smooth surface	68.00	22.61
YLB 5	2.89	Light green with smooth surface	78.10	25.41
YLB 50	2.50	Greenish white with purple tip	70.20	23.22
YLB 82	2.89	Dark green	70 .00	18.87
YLB 89	1.94	Light green	65.30	24.53
YLB 96	2.20	Greenish white with smooth surface	65 .20	24.05
YLB 117	2.95	Light Green with smooth surface	73.10	26.68
YLB 126	1.77	Purple	54.80	18.80
YLB 129	1.85	Greenish white with red tip	44.70	17.33
Sharika	1.92	Greenish white with purple tip	42.3	19.50
Lola	2.39	Greenish white with red tip	45.00	19.70
Vellayani Jyothika	2.04	Light green with mild rough surface	50 .00	21.60

Table 2. Data on the performance of yard long bean selections in first Comparative Yield Trial (INM) during 2014-15

Accessions	No. of pods /plant	Pod weight (g)	Pod length (cm)	Pod yield / plant (kg)
Vellayani Jyothika	70	19.85	54.70	0.804
Lola	155	19.00	49.30	1.466
Arka Mangala	95	24.93	69.40	1.923
Sharika	84	14.78	45.60	0.886
YLB 5	125	23.60	77.60	2.45
YLB 50	319	13.06	70.10	2.455
YLB 82	184	15.35	72.10	2.357
YLB 117	118	21.11	73.70	2.075
CD (0.05)	9.54	1.87	14.46	0.39

Table 3. Data on the performance of yard long bean selections in second Comparative Yield Trial (INM) during 2015-16

Accessions	No.ofpods/ plant	Pod weight (g)	Pod length (cm)	Yield/plant (kg)
Vellayani Jyothika	122.11	19.37	52.80	2.20
Lola	139.30	17.90	50.30	2.34
Arka Mangala	109.71	24.89	67.90	2.38
Sharika	140.63	15.18	46.60	2.25
YLB 5	137.50	23.70	78.20	2.45
YLB 50	167.65	16.06	69.10	2.36
YLB 82	174.42	15.35	71.10	2.32
YLB 117	128.00	21.00	72.90	2.07
CD (0.05)	7.33	1.02	14.10	0.46

Table 4.Data on the performance of yard long bean selections in third Comparative Yield Trial (INM) during 2016

Accessions	No.of pods/plant	Pod weight (g)	Yield/ plant (kg)
Vellayani Jyothika	91.67	18.62	1.72
Lola	106.92	15.90	1.70
Arka Mangala	86.58	24.27	1.98
Sharika	112.30	14.96	1.68
YLB 5	92.34	24.15	2.23
YLB 50	93.90	14.59	1.37
YLB 82	135.49	14.54	1.97
YLB 117	81.10	19.73	1.60
CD (0.05)	6.25	2.05	0.31

the performance in IET, 8 accessions were promoted to comparative yield trial. Data on comparative yield trials are given in Table 2 to Table 4.

Pooled data on comparative yield trial is presented in Table 5. Pooled data revealed considerable variation among the entries in yield and quality parameters. Results of the study revealed that the range of yield components especially the number of pods per plant varied from 94.60 (Vellayani Jyothika) to 193.51 (YLB50). Similar findings were reported by Mali et al. (2021). YLB 50 was significantly superior to other varieties with regard to maximum number of pods per plant. YLB 50 was followed by YLB 82 (164.64), Arka Mangala (133.74) and YLB 5 (118.27) which was also significantly different among each other. Considerable variation in number of pods per plant among accessions can be supported by previous studies done by Dipikaben et al. (2018). Significant variability among accessions for pods per plant and pod length was reported early by Manggoel et al. (2012)

Among the accessions, pod weight (g) was highest for Arka Mangala (24.70 g) and it was statistically on par with treatment YLB 5 (23.82 g). Lowest pod weight (g) was recorded by the accession YLB 50

Table 5. Pooled data on the performance of yard long bean selections in three Comparative Yield Trials(INM)

Accessions	No. of pods/plant	Pod weight (g)	Yield /plant (kg)
Vellayani Jyothika	94.60	19.28	1.61
Lola	106.92	17.60	1.84
Arka Mangala	133.74	24.70	2.16
Sharika	112.31	14.97	1.61
YLB 5	118.27	23.82	2.38
YLB 50	193.51	14.57	2.10
YLB 82	164.64	15.08	2.22
YLB 117	109.03	20.61	1.92
CD (0.05)	13.79	3.12	0.39

(14.57). Variation in observations in pod weight was in agreement with the previous report of Joydhandh aet al. (2017) in cowpea. With regard to yield, highest yield of green pods per plant (kg) was recorded by YLB5 (2.38) and it was at par with accessions *viz.,* YLB 82 (2.22), Arka Mangala (2.16) and YLB 50(2.10). Lowest pod yield per plant was recorded by Vellayani Jyothika and Sharika (1.61). Number of plants and Pod weight contributed to maximum yield. Variability in yield and yield components in cowpea was reported earlier by Diwaker et al. (2017). Difference in yield attributes and yield may be due to the influence of agroclimatic condition and genetic variation among the accessions (Sunitha, 2008). The mean data pertaining to acceptance qualities of the accession is given in Table 6.

Shelf life was highest for YLB 117 (5-7 days) followed by YLB 5, Vellayani Jyothika and Arka Mangala respectively (5-6 days). YLB 82 and Sharika had the lowest shelf life of 3-4days. Maximum pod length was recorded for YLB 5 (78.90 cm) followed by YLB 117 (73.30 cm). Shortest pod length was observed for the variety Sharika (46.10 cm). Data on the performance of yard long bean accessions in comparative yield trials are given in Table 7. Among the entries, Arka Mangala and YLB 82 (37 days) were early to flower whereas Lola took more days to flower (47 days). Vellayani Jyothika, Arka Mangala and YLB 82 had a crop duration of 90-120 days. YLB 5 recorded a crop

Table 6. Mean data on acceptance qualities of the yard long bean accessions(CYT)

Accessions	Average shelf life (days)	Cooking quality	Average pod length (cm)
Vellayani Jyothika	5-6	Good	53.78
Lola	4-5	Excellent	49.80
Arka Mangala	5-6	Good	68.65
Sharika	3-4	Excellent	46.10
YLB 5	5-6	Good	78.90
YLB 50	4-5	Good	69.60
YLB 82	3-4	Fair	71.60
YLB 117	5-7	Excellent	73.30

Table 7. Data on the performance of yard long bean accessions in Comparative Yield Trials

Accessions	Days to first flowering	Pod colour	Crop duration (days)
Vellayani Jyothika	44	Light green with mild rough surface	90-120
Lola	47	Greenish white with purple tip	100-135
Arka Mangala	37	Light green with smooth surface	90-120
Sharika	44	Greenish white with purple tip	100-135
YLB 5	41	Light green with smooth surface	90-130
YLB 50	46	Greenish white with purple	100-135
YLB 82	37	Dark green	90-120
YLB 117	43	Light green with smooth surface	100-130

Table 8. Field reaction of yard long bean to various biotic stresses in the Comparitive Yield Trials.

Accessions	Pest and Disease Incidence					
	Pod borer	*Cercospora*leaf spot	*Pythium*rot	*Collectotrichum*attack	*Fusarium*wilt	Mosaic*
YLB 5	+	–	–	+	–	+
YLB 50	+	–	–	+	+	+
YLB 82	+	–	–	+	–	+
YLB 117	+	–	–	+	–	+
Sharika	+	+	+	+	+	+
Lola	+	+	+	+	+	+
Vellayani Jyothika	+	+	+	+	–	+
Arka Mangala	+	–	–	+	–	+

*Mosaic disease is noted only when planted during summer. *'+' denotes the presence of pest and diseases. *'- 'denotes the absence of pest and diseases.

duration of 90-130 days. YLB 117 had a crop duration of 100-130 days. Lola, Sharika and YLB 50 recorded the longest crop duration of 100-135 days. Field reaction of various accessions to biotic stresses during CYT is given in Table 8. All the accessions were susceptible to pod borer attack. Mosaic incidence was noted during summer. It may be due to high population of vectors during summer. *Collectotrichum* leaf spot was seen only in YLB 5, YLB 82, YLB 117 and Arka Mangala. YLB 50, Sharika and Lola were susceptible to fusarium wilt which is one of the major problems of cowpea growing areas of Kerala. Considering the above facts mentioned and on the basis of pod length, yield, fusarium wilt incidence and consumer acceptability, 4 accessions *viz.,* Lola, Arka Mangala, YLB 5, YLB 117 along with check variety NS 621 (F1 hybrid) were carried over to farm trials. Lola was selected as it was excellent in cooking quality and dominating variety in the region. Arka Mangala was found to be not affected by fusarium wilt and was also outstanding for yield and shelf life. YLB 5 was superior in pod length which is one of the market preferred qualities. YLB 117 had good pod length, shelf life, cooking quality and tolerance to fusarium wilt. Though accessions YLB 50 and YLB 82 had good yield, both were not selected for farm trial as YLB 50 was found susceptible to fusarium wilt and YLB 82 had least shelf life. During the farm trials (Table 9 and 10), the accession YLB 5 out yielded the other varieties in yield plant^{-1} (20.72 t ha^{-1}) and was found to be superior to other varieties (Fig.1).

Figure 1. A general view of YLB 5

Table 9. Yield data from different locations of yard long bean under Farm trial.

Accessions	L1		L2		L3		L4	
	Yield/plot (40m$^{2)}$	Yield (t/ha)	Yield/plot (40m$^{2)}$	Yield (t/ha)	Yield/Plot (40m$^{2)}$	Yield (t/ha)	Yield/plot (40m$^{2)}$	Yield (t/ha)
Lola	60.20	15.05	54.60	13.65	50.20	12.50	62.38	15.60
Arka Mangala	74.39	18.85	74.89	18.72	77.80	19.82	72.1	18.08
YLB 5	80.40	20.10	86.25	21.56	85.41	20.35	83.00	20.75
YLB 117	69.24	17.31	68.54	17.14	70.02	17.12	71.72	17.93
NS 621	79.13	19.83	81.31	20.32	84.20	20.10	80.43	20.11

Table 10. Mean Data of yard long bean accessions under Farm Trial

Accessions	Yield/plot(40m$^{2)}$	No. ofpods/plot	Yield (t/ha)
Lola	56.85	2992.10	14.20
Arka Mangala	75.80	3145.20	18.87
YLB 5	83.77	3505.00	20.72
YLB 117	69.88	4020.70	17.38
NS 621	81.27	3907.21	20.10
CD (0.05)	8.82	230.16	1.27

Figure 2. Pods of YLB 5

Figure 3. Pale lilac flowers of YLB 5

Cowpea is considered to be a promising climate resilient food legume of twenty first century (Tripati et al., 2019). Variety suitable to a particular area helps to achieve higher yield and returns, thereby benefiting the farmer for uplifting his standard of living. The trial on identification of the most suitable yard long bean variety under integrated nutrient management system suitable for riverine alluvium of Upper Kuttanad revealed that the accession YLB 5 excelled in terms of yield. The colour, length and smooth surface of pods made it attractive and preferential from consumer point of view (Fig.2). The variety can be planted during September-October. It has duration of 90-130 days. The morphological traits of YLB 5 that make it different are trailing growth habit, green stem and petiole with pale lilac flowers (Fig.3). It takes 41 days for first flowering and has appealing long light green pods with smooth surface. It possess good cooking quality. It had a pod length of 78.60 cm with a maximum of 79.20 cm. Average pod weight was 24.22 g. Harvested pods remained fresh for 5-6 days. Seeds were deep brown in colour with white specks at one end (Fig.4). Potential and average yield was 21.6 tha^{-1} and 20.72 tha^{-1} respectively. The average yield per plant was 2.76 kg. Considering

Figure 4. Seeds of YLB 5

these attributes, the accession YLB 5 has been released as KAU Mithra for Upper Kuttanad region of Kerala.

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