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Original Research Article

Bvm-2 – An Economically Profitable Extra Early Baby Corn Cultivar for Eastern India

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A B S T R A C T

Maize (*Zea mays* L.) serves as a staple food for human being and quality feed for animals. Maize plant provides good quality green fodder, baby corn, green cob and finally grain when harvested at 30-45 days, 45-60 days, 65-75 days and 80-100 days, respectively, after sowing. Due to change in food pattern and shift in cropping system, maize is gaining importance as baby corn, green ear, grain yield, popcorn *etc*. for human consumption. Baby corn is unfertilized tender corn harvested immediately after emergence of silk. It is a profitable crop that allows diversification of production, aggregation of value and increased income. Any corn cultivar with higher prolificacy and better tolerance to high plant density can be used as baby corn. Baby corn contains about 10g/100g crude protein, 81.97% Carbohydrate, 4.43g/100g crude fat, 17.76 mg/100g Calcium, 197.89 mg/100g Phosphorus, 2.73 mg/100g Iron content, 0.14 g/100g total soluble sugar with energy content of 375.67Kcal/100g. The paper deals with suitability and profitability of a baby corn variety 'Birsa baby corn-1' (BVM-2) that have been developed for cultivation in rainfed upland condition of Eastern India. BVM-2 is a high yielding, early maturing, yellow-grained and high quality variety of maize. It was developed from C_3 cycle of random mating of a broad-based population made by crossing six open-pollinated composite varieties in BAU, Ranchi, Jharkhand, India under DFID funded BAU-GVT- collaborative project. Being an early maturing variety, BVM-2 has been cultivated as baby corn and harvesting starts at 48 days and continues up to 65 days. It was evaluated across the nation (all five agro-climatic zones of India) during *Kharif* 2014-2016 and also under station breeding program. Baby corn yield of BVM-2 is higher than HM-4, the national check hybrid of baby corn. Being a composite variety BVM-2 can be easily multiplied and maintained by the farmers. It can be easily adopted for intensification of cropping system as catch crop in the intermediate period between two successive crops thus increasing the economic profitability of farmers.

Keywords

Baby corn, Early maturing, Increased income, Profitability

Introduction

Maize (*Zea mays* L.) is the third most important cereal crop after rice and wheat and has the highest production potential among the cereals. Maize has a major distinction as compared to other crops with respect to its utility pattern because of its several diverse types, like quality protein

maize, sweet corn, popcorn, baby corn, etc. (Parihar *et al.,* 2016). It serves as a staple food for human being and quality feed for animals. Due to change in food pattern and shift in cropping system, maize is gaining importance as baby corn, green ear, grain yield, popcorn *etc*. for human consumption. Maize plant provides good quality green fodder, baby corn, green cob and finally grain when harvested at 30-45 days, 45-60 days, 65-75 days and 80-100 days, respectively, after sowing. Baby corn is tiny, immature and unfertilized ears of corn harvested 1 to 2 days after silk emergence, while the ears are still immature (Bairagi *et al.,* 2015). The dehusked ears of baby corn is nutritionally rich with minerals, carbohydrates and vitamins and can be eaten as raw as vegetables or in different recipe preparations.

Baby corn is good option for crop diversification and value addition of maize as well as growth of food processing industries. Being a short duration crop, it can be included in multiple cropping systems also. Baby corn is one of the most important dual purpose crops grown round the year in India (Singh *et al.,* 2015). Due to its high succulence, palatability and digestibility, it is considered to be an ideal fodder crop and it can be used at any stage of its growth (Singh *et al.,* 2006). Baby corn can be grown throughout the year but its growth and yield potential vary across the growing season. Early harvesting (<55 days) provides opportunity to take baby corn as a catch crop and helps the crop to escape from many of those biotic and abiotic stresses which appear after the flowering stage. Baby corn ears which are 10 to 12 cm long and having a diameter of 1.0 to 1.5cm with regular ovule row arrangement are preferred in the market (Golada *et al.,* 2013). Because ears can quickly become too large and tough to be sold as baby corn, frequent harvests of every 2 to 3 days are necessary (Chutkaew and Paroda, 1994). The harvest period can last 2 to 4 weeks. A single planting may be harvested 9–12 times over a period of 3–4 weeks (Miles and Shaffner, 1999 and Bar-Zur and Saadi, 1990). Baby corn is a high value crop which gives good returns in short period of time (About 60-63 days) with bonus of 50-60 tons/ha green fodder. Hence, it is best suited for multiple cropping. It also acts as a contingent crop at the time of crop failure. Baby corn is not only a cash crop but also a catch crop. Towards diversification and value addition through cultivation of baby corn for vegetable purpose is emerging as a highly profitable activity. Considering the facts, cultivation of babycorn is easily adopted for intensification of cropping system as catch crop in the intermediate period between two successive crops thus increasing the economic profitability of farmers. Its cultivation is labour intensive and has potential for employment generation.

Materials and Methods

BVM-2 has been developed through broad based population extracted from random mating of three yellow flint (*i.e* BM-1, Suwan and Chandan) and three white flint (i.*e* GDRM-178, Rudrapur local and Sweta) maize composite. It is an extra early variety developed by BAU, Ranchi through participatory plant breeding under DFID, UK funded BAU- GVY Collaborative project. The variety was released mainly for the grain purpose in the year 2005 and the same has been evaluated for baby corn purpose in station trials of BAU Ranchi. It was evaluated for three consecutive years in IVT, AVT-I and AVT-II in all the five zones through All India Co-ordinated Research Trials of Maize for 2014 – 2016 across all the five agro climatic zones of country. The performance is compared with HM-4 the

national check hybrid and Vivek hybrid 27, the most promising hybrid.

Results and discussions

Performance of BVM-2 in co-ordinated trials

The mean values of three years (2014-2016) observation of different traits in all the five zone are depicted in figures (1-9). The average days to tasseling and silking in all the five zones for BVM-2 (44.35 & 48.5 days) was earliest to Vivek Hybrid 27 (47.00 & 51.5 days) and HM-4 (50.50 & 54.80 days). In North Eastern Plains Zone (Zone III) baby corn yield with husk and without husk for BVM-2 was also higher than national check HM-4. The overall mean value across all the zone for all variety is presented in table 1.

Performance of BVM-2 in Station trial

The performance of BVM-2 in station has been recorded and presented in table 2 and in figures 10-15. It was recorded that its performance was superior to check with early days to tasseling and silking with higher baby corn yield without husk

Response of BVM-2 to different fertilizer doses

BVM-2 was evaluated under three fertilizer combination of N:P:K in BAU, Ranchi centre under ICAR trail in kharif (table 3). Highest babycorn yield was recorded with the fertilizer dose of 180:90:60 N:P:K kg/ha. Highest B:C ratio of 1:51 was also observed with the application of same (180:90:60 N:P:K kg/ha) fertilizer application.

Babycorn cultivation with different nutrient management practices

Trail was conducted to evaluate the response of BVM-2 under four different nutrient management practices like 100 % inorganic, 100 % organic, 50% organic + 50% inorganic and 50% organic + 50% inorganic + Azotobacter (table 4). At different nutrient management practices net return was highest at 100% inorganic nutrient with B:C ratio of 1:65 which was significantly superior to the rest treatments.

Reaction to maize stem borer (*Chillo partellus*)

Reaction of BVM-2 against *Chilo partellus* was estimated by calculating LIR on 1-9 scale (table 5). In different locations of zone II, III, IV, and V under artificial inoculation and in BAU, Ranchi centre under natural condition.

The LIR value varied from 1.8 to 7.6 with an overall mean of 4.07 which indicated moderately susceptible reaction to *Chilo partellus* under artificial inoculation. In Ranchi, under natural condition its score is 2.43 which indicated least susceptibility to stem borer (table 6).

Reaction to major diseases

The variety was screened against different diseases in their respective hotspots of different zones for three years.

For TLB BVM-2 was moderately resistant at zone 1 but was susceptible at zone IV. For MLB, BVM-2 was resistant in zone I and zone III but was moderately resistant in zone II.

Table.1 Overall mean performance of varities across the Zone

Variety	Plant Height (cm)	Ear Height (cm)	Days to Tasseling	Days to 50% Silking	Baby corn length (cm)	Baby corn Girth (cm)	Fodder yield (kg/ha)	Baby corn yield	
								with husk (kg/ha)	without husk (kg/ha
BVM-2	170.63	71.6	44.35	48.47	9.1	3	20081	5910	1672.33
Vivek Hybrid 27	172.95	69.9	47	51.45	8.9	2.3	23922	6941.5	1907
HM 4(C)	171.1	75.57	50.5	54.83	9.15	3	21448.3	5450.73	1454

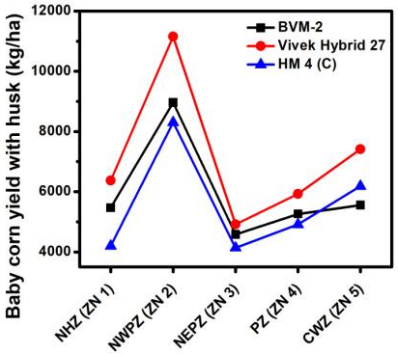


Fig. 1

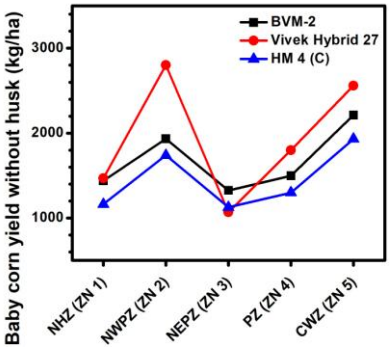


Fig. 2

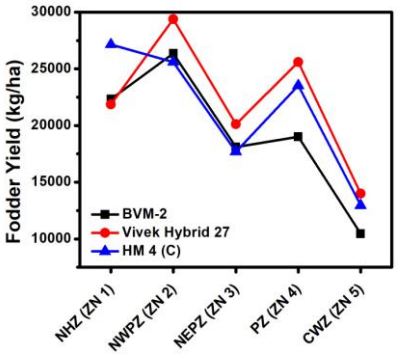


Fig. 3

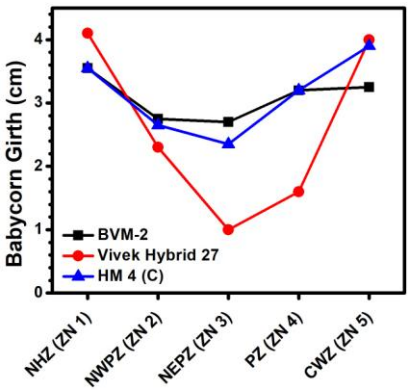


Fig. 4

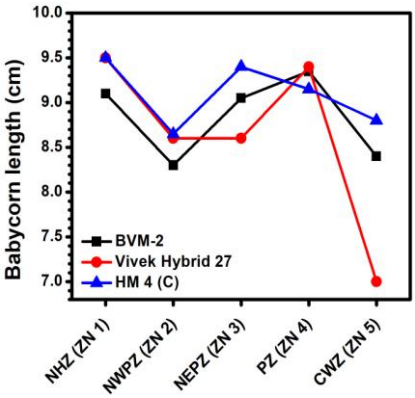


Fig. 6

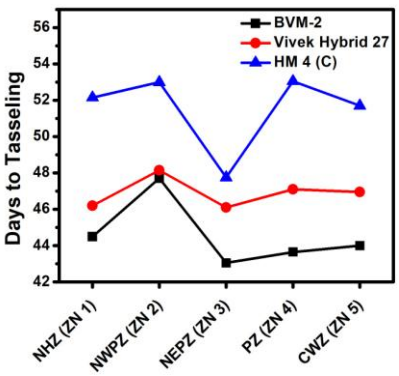
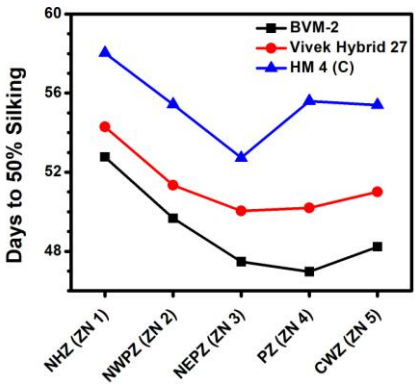


Fig. 5



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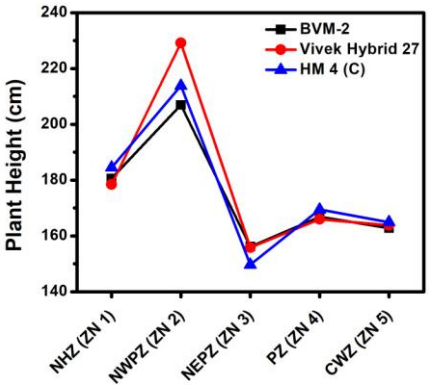

Fig. 9

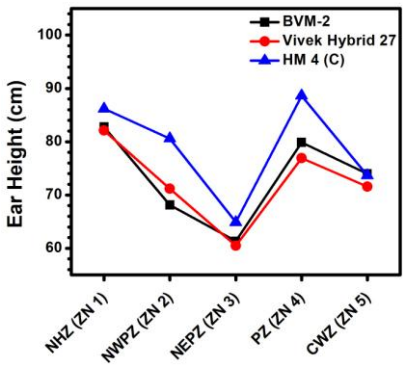

Fig. 8

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Table.2 Performance of BVM-2 in Station trial

Year of testing	Entry	Baby corn yield(kg/ha)		Days to 50% tasseling	Days to 50% Silking	Plant Height (cm)	Ear height (cm)
		with husk	without husk				
2010	BVM-2	6788.00	1376.00	46.00	49.00	175.30	81.90
	check	7027.00	1270.00	50.70	54.60	193.90	113.20
2012	BVM-2	7789.00	1401.00	41.30	44.30	189.30	82.30
	check	8132.00	1317.00	54.70	59.70	197.90	87.60
2013	BVM-2	9223.44	1496.00	42.25	46.75	172.35	72.55
	check	7522.91	1257.00	52.75	58.50	187.95	86.05
Mean Value	BVM-2	7933.48	1424.33	43.1833	46.6833	178.983	78.9167
	check	7560.64	1281.33	52.7167	57.6	193.25	95.6167

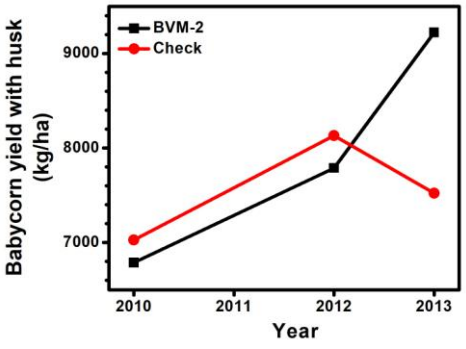

Fig 10.

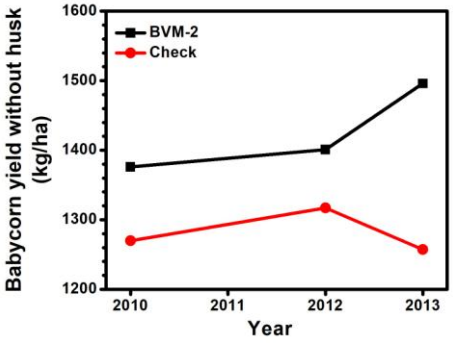

Fig 11.

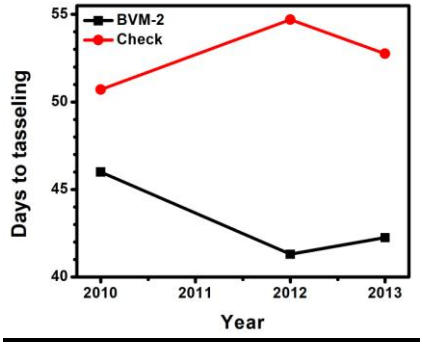

Fig 12.

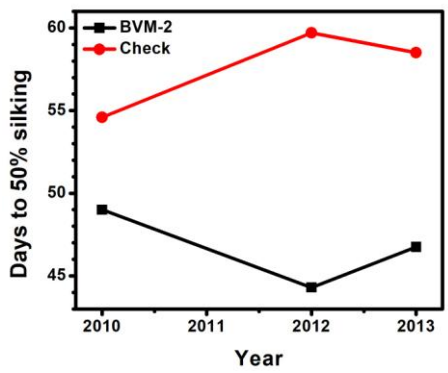

Fig. 13

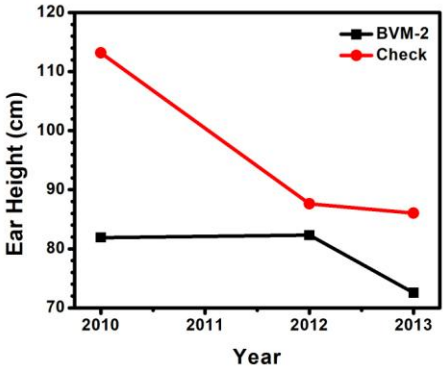

Fig. 14

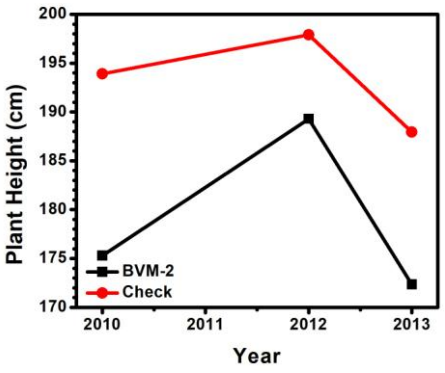

Fig. 15

Table.3 Response of BVM-2 to different fertilizer doses

Fertilizer levels (N:P:K kg/ha)	Plant height (cm)	Baby corn length (cm)	Baby corn girth (cm)	Baby corn yield		Green fodder yield (kg/ha)	Net return (Rs/ha)	B:C ratio
				Husked (kg/ha)	Dehusked (kg/ha)			
120:60:40	157.05	7.97	3.76	3552.42	753.33	21000	12883.54	1.09
150:75:50	167.76	8.69	3.94	4431.28	902.22	23479.2	17262.24	1.4
180:90:60	176.86	9.02	4.08	4624.64	980.28	25054.2	19359.59	1.51
SEm±	2.67	0.14	0.06	116.42	34.97	685.6	1133.7	0.09
CD (P=0.05)	7.83	0.42	0.17	341.46	102.56	2011	3325.23	0.27

Table.4 Response of BVM-2 to different nutrient management practices

Nutrient management practices	Plant height (cm)	Baby corn length (cm)	Baby corn girth (cm)	Baby corn yield		Green fodder yield (kg/ha)	Net return (Rs/ha)	B:C ratio
				Husked (kg/ha)	Dehusked (kg/ha)			
100 % inorganic	181.56	9.55	4.19	5101.18	1047.41	27261.1	20436.5	1.65
100 % organic	153.76	7.31	3.69	3213.55	662.59	19172.2	14013.86	1.16
50% organic + 50% inorganic	165.32	8.56	3.9	4142.63	874.07	22088.9	14886.46	1.19
50% organic + 50% inorganic + Azotobacter as seed inoculation	168.26	8.84	3.93	4353.76	930.37	24188.9	16670.35	1.33
SEm±	3.08	0.16	0.07	134.43	40.38	791.7	1309.09	0.11
CD (P=0.05)	9.04	0.48	0.2	394.29	118.43	2322.1	3839.65	0.31

Table .5 Mean leaf Injury of BVM-2 against *Chilo partellus* (LIR on 1-9 scale) under artificial inoculation

			NWPZ (Zone II)					NEPZ (Zone III)		Peninsular Zone (Zone IV)				CWZ (Zone V)			
Year of Testing		Entry	Delhi	KAR	LUDH	Mean	Reaction	DHOL	Reaction	KOLH	HYDE	Mean	Reaction	UDAI	Reaction	OV' ll mean	Reaction
2015	Artificial	BVM-2	1.8	4.6	4	3.5	MS	3.3	MS	7.6	6.1	6.9	HS	3.3	MS	4.25	MS
		HM-4	1.4	2.7	4.1	2.7	LS	2.5	LS	4.9	5.2	5.1	MS	1	LS	2.83	LS
2016	Artificial	BVM-2	3.5	4.2	5.2	4.3	MS	2.2	LS	4	6.3	5.15	MS	4	MS	3.91	MS
		HM-4	4.3	2.2	4.9	3.8	MS	4.5	MS	3	6.1	4.55	MS	3.3	MS	4.04	MS
Weighted mean		BVM-2	2.65	4.4	4.6	3.88	MS	2.75	LS	5.8	6.2	6	MS	3.65	MS	4.07	MS
		HM-4	2.85	2.45	4.35	3.22	MS	3.5	MS	3.95	5.65	4.8	MS	2.15	LS	3.42	MS

Table.6 Reaction of BVM-2 to *Chilo partellus* under natural condition

	1st year		2nd year		3rd year		Overall	
	Score	Reaction	Score	Reaction	Score	Reaction	Score	Reaction
BVM-2	2.2	LS	1.8	LS	3.3	MS	2.43	LS
Check	2.6	LS	2.4	LS	3	LS	2.66	LS

Table.7 Reaction of BVM-2 to Tursicum leaf blight under artificial inoculation

Zone I							
		BVM-2		Vivek Hybrids		HM 4(C)	
		Score	Reaction	Score	Reaction	Score	Reaction
Artificial	2014 **	3.9	MS	3	MR	3	MR
	2015 **	3.2	MS	2.5	MR	3.4	MS
	2016 *	3.8	MR	_		3.4	MR
Zone III							
		BVM-2		Vivek Hybrids		HM 4(C)	
		Score	Reaction	Score	Reaction	Score	Reaction
Artificial	2014 **						
	2015 **						
	2016 *	6.5*	MS			6	MS
Zone IV							
		BVM-2		Vivek Hybrids		HM 4(C)	
		Score	Reaction	Score	Reaction	Score	Reaction
Artificial	2014 **	4.5	S	3.25	MS	3	MR
	2015 **	4.5	S	2.75	MR	3.65	MS
	2016 *	8.3	S			5.3	MS

* Scoring in 1-9 scale; ** Scoring in 1-5 Scale

Table.8 Reaction of BVM-2 to Maydis Leaf Blight

Zone I							
		BVM-2		Vivek Hybrids		HM 4(C)	
		Score	Reaction	Score	Reaction	Score	Reaction
Artificial	2014 **	3	R	3	R	3	R
	2015 **						
	2016 *	1.5	R			1	R
Zone II							
		BVM-2		Vivek Hybrids		HM 4(C)	
Score	Reaction	Score	Reaction	Score	Reaction	Score	Reaction
Artificial	2014 **	3.2	MS	2.5	MR	3	Reaction
	2015 **	2.9	MR	2.2	MR	2.3	MR
	2016 *	4.3	MR		3.6	MR	
Zone III							
		BVM-2		Vivek Hybrids		HM 4(C)	
Score	Reaction	Score	Reaction	Score	Reaction	Score	Reaction
Artificial	2014 **	4	MS	3	MR	1.5	R
	2015 **	2	R	3	MR	2	R
	2016 *	1.5	R			1	R

* Scoring in 1-9 scale; ** Scoring in 1-5 Scale

Table.9 Quality parameters of BVM-2 in station trial

	Protein %	Calcium (mg/100g)	Iron (mg/100g)	Phosphorus (mg/100g)	Soluble sugar %	Crude fiber %	Dry Ash %
BVM-2	10.3	15.1	2.4	176.33	0.12	2.17	1.42
Check	9.45	15.16	2.39	165.67	0.11	2.1	1.28
CD at 5%		0.14	0.03	6.5	0.01	0.08	0.04
Sem+		0.05	0.01	2.35	0	0.03	0.02

Table.10 Performance of BVM-2 in Farmer's field of Khunti district in summer 2015

SN	Name of the farmer with address	Area for FLD in acres	Babycorn yield with husk (q/ha)
1	Sri Baddhai Munda; S/o Late Dhura Munda	1	52
2	Sri Vinasay Munda	1	57.0
3	Sri Basant Singh; S/o Late Narayan Singh	1	49.0
4	Sri Mahaver Oraon; S/o Sri Madi Oraon	1	45.0
5	Sri Lilamohan Bhagat; S/o Sri Jhiva Bhagat	0.5	51.0
6	Sri Madi Oraon; S/o Late Phaguna Oraon	0.5	58.00
7	Sri Mansuk Tiru; S/o Late Jaymasi Tiru	0.5	52.00
8	Sri Julalain mukut Tiru; S/o Sri Khistochit Tiru	0.5	57.00
9	Sri Junathan Tiru; S/o Late Jaymasi Tiru	0.5	48.00
10	Sri Sunil Tiru; S/o Late Daivid Tiru	0.5	50.00
11	Sri Haradugan Tiru; S/o Sri Mansingh Tiru	0.5	55.00
12	Sri Jakriyas Tiru; S/o Late Johan Tiru	0.5	51.00
13	Sri Jaims Tiru; S/o Late Johan Tiru	0.5	54.00
14	Sri Hairan Tiru; S/o Sri Khistochit Tiru	0.5	46.00
15	Sri Iliyas Tiru; S/o Late Tintus Tiru	0.5	58.00
16	Smt Sushela Tiru; W/o Sri Mansukh Tiru	0.5	60.00
	TOTAL / Average	10	51.8

Quality traits of BVM-2

Baby corn was estimated for various quality parameters viz., protein content, calcium content, iron content, phosphorus content, soluble sugar content, crude fiber content and dry ash content as shown in table 9 and it was found that the value of desirable nutrient content was higher in BVM-2 than check.

Evaluation in Farmer's field

The variety was demonstrated in farmer's field for babycorn cultivation under TSP program in Khunti district of Jharkhand during summer 2015. Sixteen demonstration was conducted with an area of 0.5 acre to 1.0 acre with fertilizer dose of 150: 60: 40 kg NPK per hectare.
The babycorn yield (with husk) varied from 45q/ha to 60q/ha with an average value of 51.8q/ha.

Baby corn with high ear yield also produced higher yield of husk. Green husk is considered important as animal feed on small farms. This finding is significant in selecting baby corn for husked and dehusked yields for marketing purpose. The study indicated that baby corn is good source of various nutrients like protein, crude fibre, phosphorus content etc. (Hooda and Kawatra, 2013).

Baby corn cultivation under optimum nutrient input conditions will give a positive impetus to the baby corn cultivation. Its cultivation is expected to catch the attention of more and more consumers and farmers because of its superior taste, texture and nutritional value. The baby corn industry generates employment for the rural poor, provides opportunities for higher income and has potential for export which in turn shall be very fruitfull in encouraging the livelihood security of poor farming community. BVM-2 has been identified as a variety suited to cultivation and named as Birsa baby corn-1.

Acknowledgements

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