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VEGETABLE TYPE FABA BEAN LINES IDENTIFIED-SUITABLE FOR EASTERNREGION OF INDIA

Anil Kumar Singh* and B.P. Bhatt

ICAR Research Complex for Eastern Region, Patna-800 014 Bihar

**E-mail: anil.icarpat@gmail.com*

ABSTRACT: Faba bean, being a good source of cheap protein, can be consumed fresh green as vegetable and variety of dishes are prepared from dried cotyledon. There is only one vegetable type faba bean variety "Pusa Sumeet" which has been developed at all India level by IARI, New Delhi and same is used as check variety. Three lines suitable for vegetable purpose have been developed at ICAR Research Complex for Eastern Region Patna. Single plant selection method was applied for development of these vegetable type faba bean lines. Three promising lines viz., VFBP201302, VFBP201304 and VFBP201306 were identified for vegetable purposes with green pod yield potential of 21.51 to 23.54 t/ha, suitable for Eastern parts of India.

Keywords: *Vegetable type, faba bean, germplasm, SPS, identification.*

Faba bean (*Vicia faba*) is among the oldest crops in the world but in India it is not much popular as in case of other countries (Mihailovic *et al.,* 5). Faba beans are small-seeded relatives of the garden broad bean. Faba bean, a nitrogen- fixing legume plant, is capable of fixing atmospheric nitrogen, which results in increased residual soil nitrogen for use by subsequent crops (Gasim and Link, 2). Faba bean is an annual legume and globally, third most important feed grain legume after soybean and pea (Singh *et al.,* 12). Presently faba beans are a major crop in many countries including China, Ethiopia, and Egypt (Singh *et al.*, 10). In India it is categorized as minor, unutilized underutilized, less utilized, and still not fully exploited crops (Singh *et al.,* 9). Cultivated faba bean is used as human food in developing countries and as animal feed, mainly for pigs, horses, poultry and pigeons in industrialized countries. It can be used as a vegetable, green or dried, fresh or canned. In Eastern States of India especially in hilly regions faba bean is major source of dietary protein and consumed green (vegetable) and dry cotyledons (pulse) (Gasim and Link, 2 and Singh *et al.,* 11). Greater insight into the pattern and dynamics of genetic resources of Faba bean (*Vicia faba* L.) is needed in order to understanding and establishing the relationship among collected germplasm from Bihar region. Plant exploration and collection of germplasm is quickest way to collect modest variability (Singh *et al.,* 13). The crop is widely adapted to diverse soil types, and is more tolerant to acidic soils than most legumes. It is a one of the best known "break" crop which enhances cereal yield because it decreases the occurrence of take-all and cereal cyst nematode. Faba bean is seen as an agronomically viable alternative to cereal grains. Being annual in nature it can be used as green manure having potential of fixing free nitrogen (100-350kg N/ha) (Singh and Umrao, 8; Singh *et al.,* 9). Its adoptability to any ecological condition is wonderful hence it can be grown on diverse agro-climatic conditions. In India it is mainly used as human food. Seeds are roasted and eaten like groundnut and numerous delicious preparations are made. It is good source of lysine rich protein contents (20-40 %) depending upon cultivars and agro-climatic conditions under which it is grown. In India only few varieties namely Pusa Sumeet and Vikrant (VH-82-1) have been released at National level, however some state level release has been also reported, mainly from JNKVV, Jabalpur. The present grim situation also caution towards the urgent need to develop considerable amount of high yielding varieties for this orphan / neglected crop having numerous quality and potential. Perhaps it is one of among most diversified crop which can perform better under changing climate situation (Alba and Scippa, 1, and Zohary and Hopf, 15).

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MATERIALS AND METHODS

Plant exploration and collection of germplasm is quickest way to collect modest variability (Singh and Bhatt, 7). To collect and conserve faba bean germplasm available in the Bihar, two exploration trips were executed during March & April, 2007 and April during 2008. All the 73 accessions collected were planted at main campus research farm ICAR Research Complex for Eastern Region Patna, Bihar. The field experiment was conducted during *Rabi* seasons of 2011-12 and 2012-13. All three developed lines were developed by adopting selection method due to its added advantage of adaptability of screened and developed variety (Singh *et al.,* 11). Single plant selection (SPS) method was adopted for further screening and fixing of desired trait. Selection was made from the germplasm collected from Bihar (Singh, 6). To make it uniform standard package of practices were performed at ICAR Research Complex for Eastern Region Patna in simple Randomized Block Design replicated thrice in the plot size of 12 square meters.

Fig. 1: Initial selection under pod culture at vegetative growth and at podding stage.

Furrow irrigation and raised bed planting (FIRB) is the best management practice to optimized resource utilization. Square planting (30 cm apart) was recommended for both lines for better utilization of all the resources. The texture of soil of experimental field was silty clay loam with mean pH value of 6.8, electrical conductivity 0.16 ds/m in 1:2 soils: water solution, organic carbon 0.68 per cent, with available nitrogen 244.7 kg/ha, available phosphorus 28.6 kg/ha, available potash 185.8 kg/ha, sulphur 8.3 kg/ha and zinc 0.8kg/ha. The soil samples were analysed following the procedure described by Jackson (4). Regular analysis of variance was performed for each trait for all three seasons and the combined (Pooled) analysis over seasons after testing error variance homogeneity was carried out according to the procedure outlined by Gomez and Gomez (3), using the MSTATC version 2.1 (Michigan State University, USA) statistical package design. Significant differences between the treatments were compared with the critical difference at (± 5%) probability by LSD. Data were recorded by respective crop curator on growth and development, yield attributes and seed yield as per the standard practices. Germination (%) was recorded to know the seed viability, whereas plant height was recorded from base to top of plant. After recording plant height,biometrical data recorded and computed for productive branch per plant, pods per plant and seed yield (g per plant). Similarly 100 seed weight (g) was also worked out. Above ground biomass (kg per ha) and seed yield (kg per ha) were computed based on seed weight per plot and computed for unit hectare. Seed yield (kg per ha) were finally adjusted at 12 % moisture (Singh *et al.*, 10).

RESULTS AND DISCUSSION

Promising faba bean lines explored and collected during designated exploration trip were preliminary characterized and evaluated for different traits, continuously for three years. All the accessions / promising lines were classified and grouped for their characters and were supplied to National Bureau of Plant Genetic Resources, New Delhi for Indigenous Collection Numbers (IC Numbers) for its safe deposition and future reference to other researcher actively engaged in faba bean crop improvement in India in particular

and across the world in general (Singh *et al.,* 10). During first phase we have identified two promising lines suitable for irrigated and rainfed conditions though they were more suited for dry cotyledon purpose (Singh *et al.*, 11). Single plant selection method was applied for development of all three faba bean lines for vegetable purpose (Singh and Bhatt, 7). All three lines were standardized and characters were identified/fixed for 5 consecutive seasons. The important characteristic of each line are depicted in Table 1 and 2. All the three lines developed at ICAR Research Complex for Easter Region Patna, were evaluated and compared with "Pusa Sumeet" a vegetable type faba bean line developed by IARI. All the 4 accessions, including available National check "Pusa Sumeet" were planted in Randomized Block Design and replicated thrice to know the agronomic potentiality of the developed lines in comparison to National check (Singh *et al.,* 10).

Growth and development

Results obtained under agronomic traits indicated that all the developed lines out performed with national check with respect to growth and development traits (Table1, Fig. 1). Significant differences were noticed in case of days taken to germination. Days taken to germination ranged in between 8.5 to 9.5 days. Maximum 9.5 days were taken by Pusa Sumeet (national check). Germination per cent of all the tested genotypes were ranged in between 80 to 85 per cent. Maximum plant height (84.5cm) was attained by genotype VFBP201302 (Fig. 2), whereas significantly minimum plant height (72.3 cm) was noticed in case of Pusa Sumeet (Singh *et al.,* 11). Number of branches per plant varied significantly, and the highest branching (11.5 per plant) was recorded with developed promising lines VFBP201306 (Fig. 3). Days to first flowering (anthesis) was also varied according to the length of life cycle of genotype. Minimum time (51.7 days) was taken by genotype VFBP201304 to come in to flowering. Minimum time taken for anthesis is one of the desirable traits contributing significantly in the economic yield as the particular genotype gets more time for podding (Singh and Bhatt, 11).

Fig. 2: Closeup of promising vegetable type faba bean line VFBP201302

Fig. 3: Closeup of promising vegetable type faba bean line VFBP2013306

Similar trend was also noticed in case of day to complete the life cycle. Maximum 98.5 days to complete its life cycle was taken by none other than check variety i.e. Pusa Sumeet. Corresponding minimum time (87.5 days) to come in to maturity was taken by developed line VFBP201304 (Singh *et al.,* 14).

Yield attributing characters

Yield attributing character, pod yield and finally seed yield were recorded for all the three developed lines as well as for check variety (Table 2). Number of pods per plant ranged minimum 98.4 for Pusa Sumeet to maximum 127.5 for developed line VFBP201306 (Singh *et al.,* 13.). However, pod length varied in between 6.14 to 6.52 cm (Table 2). Minimum time taken to first pod picking was

Table 1: Growth and development of developed vegetable type faba bean lines.

Name of Line / variety	Days to 50 % germination	Germination (%)	Pant height (cm)	Branch (Per plant)	Days to anthesis	Days to maturity
VFBP201302	9.0	80	84.5	9.5	53.5	94.5
VFBP201304	8.5	85	74.5	8.9	51.7	87.5
VFBP201306	8.5	85	77.9	11.5	53.5	95.5
*Pusa Sumeet	9.5	80	72.3	9.7	57.2	98.5
LSD (P= ±0.05)	0.50	NS	3.5	1.8	2.1	4.6

*National Check

Table 2: Yield and yield attributes of developed vegetable type faba bean lines.

Name of Line / variety	Pods / plant	Pod length (cm)	Seeds / pod	Green pod yield (t/ha)	First pod picking	100 seed weight (g)	Grain yield (q/ha)
VFBP201302	112.7	6.25	5.1	23.54	63.5	23.54	36.9
VFBP201304	123.4	6.52	5.6	21.51	65.5	21.05	35.7
VFBP201306	127.5	6.14	5.5	22.64	66.5	23.65	36.1
*Pusa Sumeet	98.4	6.19	5.2	18.92	69.5	22.57	29.7
LSD(P=±0.05)	4.21	0.31	0.17	1.19	2.3	NS	2.54

*National Check

ranged in between 63.5 days for developed line VFBP201302 to 69.5 days in case of Pusa Sumeet. Number of seeds per pod varied narrowly in between 5.1 to 5.6. Green pod yield (t/ha) ranged in between 18.92 (Pusa Sumeet) to 23.54 (VFBP201302). It is worth to mention here that all the developed lines were out yielded and proved superior over Pusa Sumeet (check variety). Similar trend was also noticed in case of grain yield (q/ha) which ranged in between 29.7 to 36.9, in similar fashion as it was in case of green pods yield. 100 seed weight did not vary significantly (Singh *et al.,* 12).

Conclusion

All the three vegetable type faba bean lines viz., VFBP201302, VFBP201304 and VFBP201306 were identified for vegetable purposes. The average green pod yield ranged 21.51 to 23.54 t/ha. These vegetable type lines are found suitable for Eastern Parts of India as compare to National check "Pusa Sumeet"developed for vegetable purpose.

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