Participatory Evaluation of Faba Bean (*Vicia faba* L.) Varieties for Yield and Yield Components in Wag-Lasta, Eastern Amhara, Ethiopia

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Abstract: Currently Faba bean is out of production due to pest and diseases as well as shortage of high yielding and widely adapted varieties. Therefore, participatory variety selection was conducted at Lalibela, Hamusite and Dehana districts of Wag-Lasta on both Trial station and on farmer's field, in 2016 main cropping season, to evaluate and select high yielder faba bean varieties involving farmers. Eight released faba bean varieties (Walki, Moti, CS-20DK, Obsie, Dosha, Tumsa, Gora, and Hachalu) including a local check were tested using Randomized Complete Block Design with three replications at on station of each trial site. The mother trial was done at trial stations, whereas the baby trials were done at three farmer's field per districts. As ANOVA revealed that, Significant differences ($p \leq 0.01$) were observed among varieties for plant height, pods per plant, seeds per pod, 100seeds weight and grain yield. Among the tested varieties, variety Dosha (2722.20kgha^{-1} & 2197.90kgha^{-1}) was superior in grain yield at both Lalibela and Hamusite district respectively whereas, higher grain yield was recorded from Cs-20DK (2329.17kgha^{-1}) & Tumsa (1927.08kgha^{-1}) varieties at Dehana. The local variety was lower yielder (1143.66kgha^{-1}) at Dehana. Dosha as preferred by farmers that scores higher mean value (59.83 & 45.67) at Lalibela and Hamusite respectively whereas least mean value was recorded from Local (24.50) variety. While the maximum score (55.8) was recorded on CS-20DK variety at Dehana. Therefore, based on farmers' preference value and biological data, Dosha variety was selected for production in Lalibela and Hamusite districts while CS-20DK was selected for production in Dehana districts.

Keywords: Baby trial; faba bean; Mother trial; participatory

1. Introduction

Legumes are important components of various farming systems in the world. Faba bean is one of the earliest domesticated cool season food legumes in Ethiopia. Ethiopia is the second largest faba bean producer in the world next to China (Teklay *et al*., 2014). In addition to food faba bean plays a great role in every aspect of Ethiopian life not only as food but also the straw and the seed as feed for animals as well as straw or haulms as firewood, green manuring and silage-making (Comlanvi, 2011). Besides this, it plays an important role in the restoration of soil fertility through atmospheric nitrogen fixation, that provides agricultural sustainability (Agegnehu and Fessehaie, 2006; Ronner *et al*., 2013). Faba bean is the first among pulse crops cultivated in Ethiopia and leading protein source for the rural people and used to make various traditional dishes (Emiola and Gous, 2011; Asnakech et *al*., 2017) and also serves as sources of foreign currency to the country (Shahidure *et al*., 2010; Agegnehu and Fessehaie, 2006).

In Ethiopia, pulse crops are grown annually on approximately 1652 844.19 hectares of land, of these, 443 966.09 hectares were covered by faba bean, with annual production of 8 486 545.69 quintals (CSA, 2016). In Waghimra zone, faba bean production covers about 6 153.58 hectares of land, within 39 634 numbers of holders with its production of 51 587.89 quintals or 8.38qtha^{-1} (CSA, 2016).

In spite of huge area coverage and its importance, the productivity of faba bean is about 1.912tha^{-1}, far below crop's potential > 5 tha^{-1} (CSA, 2016). This may be to different biotic and abiotic factors, the use of old and low yielding genetic potential of the wildly growing local cultivars and unavailability of high yielder cultivars (Anteneh *et al*., 2018; Tafere *et al*., 2012).

Participatory variety selection (PVS) is a more rapid and cost-effective way of identifying farmer-preferred varieties and it ensures the adoption of new varieties (Witcombet *et al*., 1996). In addition to this, farmers' participation in varietal selection provides adequate exposure to new varieties and high rate of replacement, strong extension network, that generally gave farmers access to new cultivars, to maximize their productivity and to improve the livelihood of their families (Tafere *et al*., 2012). Moreover, participatory research increases the job efficiency of the scientists and farmers' knowledge, that enables to be retained effectively from year to year (Wondimu, 2016; Tafere *et al*., 2012). Therefore, this study was initiated to evaluate and select high yielder faba bean variety/ varieties, through farmers' participation.

2. Materials and Methods

2.1. Description of the Study Area

The experiment was conducted at the major Faba Bean producing areas (Lalibela, Hemusite and Dehana) of Wag-Lasta both on trial station and on farmer's field. Lalibela is located in North Wollo Zone while both Hamusite and Dehana are located in

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Waghimra Zone at Sekota Zuriye and Dehana ward respectively.

Table 1. Description of the locations used for evaluation of faba bean varieties.

Location	Altitude	Rainfall	Soil type
Lalibela	2400masl	895.2mm	Black (vertisol)
Hamusite	2200masl	774.3mm	Black sandy
Dehana	2400masl	998.2mm	Black

2.2. Treatments and Design

Eight improved faba bean varieties (Walki, Moti, CS-20DK, Obsie, Dosha, Tumsa, Gora, and Hachalu) obtained from Holleta Agricultural Research Center including local check were tested in Randomized Complete Block Design (RCBD) within three replications. Mother trials were planted at the trial site of each location and other three farmer fields were planted with one replication each, considered as baby trials at each location. The trial was planted on plot size of 3m *2.4m within six rows. Spacing between replication, plots, rows, and plants was 1m, 0.5m, 0.4m, and 0.1m respectively. Local checks of respective locations were used as checks at each trial site. Three farmers field was used for evaluation and used as a replication. Sowing was done during onset of rainfall with the application of Diammonium phosphate (DAP) fertilizer at the recommended rate of100 $kgha^{-1}$ and seed rate of 175$kgha^{-1}$.

2.3. Data Collection

Agronomic data were collected on plot and plant basis from the mother trial. Hundred seed weight (g), plant height (cm), number of branches per plant, number of pods per plant, and number of seeds per pod, were evaluated on five randomly taken plants from the middle four rows in each plot. Biomass (g) and grain yield (g) of the middle four rows in each plot was measured and converted to kilogram per hectare for analysis. Farmers' evaluation and selection data were collected on plot basis from the three baby trials of each trial location. The selection was carried out at two different growth stages (at the start of flowering and physiological maturing). 9 Agricultural development agents, 26 men, and 8 women farmers have participated in the selection process. The ranking procedures was explained to Agricultural development agents and farmer participants, as well as they have discussed and set the selection criteria ranging from 1 to 5 (5 = very good, 4 = good, 3 = average, 2 = poor and 1 = very poor) for each variety.

2.4. Data Analysis

The recorded agronomic data were subjected to the analysis of variance (ANOVA) using Statistical Analysis System (SAS 9.1.3) and Mean separation was carried out using least significant Difference (LSD) test at 5 % probability level. Farmers' selection data were analyzed using the simple ranking method; The ranking was done on consensus where differences are resolved through discussion in accordance with the given value (De Boef and Thijssen, 2007).

3. Results and Discussion

3.1. Analysis of Agronomic Traits, Yield components, and Farmer's Preference at Lalibela

Agronomic traits, i.e., days to flowering, days to maturity, plant height, number of primary branches per plant and yield components (number of pods per plant, number of seeds per pod, biomass, grain yield and hundred seed weight) were analyzed (Table 2). Analysis of variance showed that highly significant difference ($p \leq 0.01$) was observed among tested faba bean varieties in plant height. The maximum plant height was recorded from Tumsa, Gora, and Dosha varieties with a height of 117.40 cm, 116.33 cm and 110.67 cm respectively; while the shortest plant height (89.10 cm) was recorded on Local variety (Table 2). This result was in line with the work of Teame *et al.*(2017)who reported that Hachalu (120.70 cm)and Dosha (110.00 cm) varieties were the longest and Local variety was shortest at the southern zone of Tigray regional state. The analysis of variance revealed that there was a highly significant difference among faba bean varieties regarding the number of branches per plant and the highest number (2.90) was recorded from CS-20DK and Gora varieties, followed by Dosha (2.70) variety (Table 2).

Number of pods per plant and seeds per pod were significantly affected by varieties ($p \leq 0.01$). The maximum number of pods per plant and seeds per pod were recorded on variety Dosha with a mean score of 20.50 and 3.07 respectively, but the lowest pods and seeds were scored from a Local variety (Table 2). Likewise, Teame *et al.*(2017)and Tafere *et al.*(2012) reported the significant difference among faba bean varieties as regard as the number of pods per plant and seeds per pod.

The varieties significantly ($p \leq 0.01$) varied for 100 seed weight, indicating the variations among varieties. Of all tested varieties, Gora, Moti and Hachalu produced the heaviest seeds with an average mean score of 85.50g 82.67g and 80.83g respectively. whereas, the lowest 100 seed weight(42.00gm) was recorded from a Local variety (Table 2). Ashenafi and Mekuria (2015) also reported the significant difference among faba bean varieties in 100 seed weight.

The statistical analysis showed that a highly significant ($P \leq 0.01$) difference within the tested varieties on grain yield. The maximum grain yield (2722.20$kgha^{-1}$) was harvested from Dosha variety, followed by Hachalu (2579.90$kgha^{-1}$) and Tumsa (2444.40$kgha^{-1}$), while the lost grain yield (1228.20$kgha^{-1}$) was recorded from a local variety (Table 2). Dosha variety had a yield advantage of 121.64%, over the Local variety. This result agreed with Teame *et al.* (2017) who reported that the highest grain yield was obtained on varieties Dosha and Tumsa, which was 3891.00 and 3437.00$kgha^{-1}$, respectively and Dosha had 55.45% yield advantage over Local variety. Ashanafi and Makuria(2015) had also reported yield variation from 3703.7 – 4886.8$kgha^{-1}$ and 3436.2 – 4701.6$kgha^{-1}$ in Agarfa and Sinana trial sites respectively.

3.1.1. Farmer's Variety Evaluation

Three Agricultural development agents, 10 men, and 4 women farmers have participated in the selection. They set the criteria; plant establishment, overall performance, stem strength, pod setting, earliness and seed size to select the best variety. Dosha (59.83) scored the highest value and the lowest was scored by Local (24.5). Hachalu (57.5) and Gora (56.67) were ranked as second and third best varieties by farmers, respectively (Table 3). In line with this finding, Teame *et al.*(2017) stated that Dosha was selected as top ranking or adapted variety by farmers' selection. The same variety had better performance and was high yielder from the analysis of researchers' collected data.

Table 2. Mean grain yield and other agronomic traits of faba bean at Lalibela.

Variety	DF	DM	PH(cm)	BRP	PDP	SPD	BM(kgha^{-1})	GY(kgha^{-1})	SW(g)
Walki	59	102	109.13	2.73	20.33	2.47	7760.40	1929.70	57.50
Moti	57	107	104.53	2.40	14.33	2.53	8437.50	1553.10	82.67
CS-20 DK	59	103	110.60	2.90	15.07	3.00	7929.70	1910.90	58.00
Obsie	58	107	103.23	2.60	12.23	2.40	7838.50	2100.70	77.33
Dosha	61	104	110.67	2.70	20.50	3.07	9583.30	2722.20	77.17
Tumsa	61	109	117.40	2.50	14.80	3.00	10000.00	2444.40	79.33
Gora	61	108	116.33	2.90	13.17	2.90	10000.00	2269.50	85.50
Hachalu	61	105	110.07	2.53	15.63	2.70	9583.30	2579.90	80.83
Local	56	100	89.10	2.33	11.10	2.67	5625.00	1228.20	42.00
Mean	59	105	107.89	2.62	14.79	2.75	8528.65	2082.07	71.15
LSD	NS	NS	9.23 **	0.3**	2.67**	0.39**	1552.20**	294.7**	6.2**
CV	4.49	3.28	4.944	6.56	10.44	8.11	10.51	8.18	5.05

Note: NS=non-significant, *= significant, **=highly significant, DF = days to flowering, DM = days to maturity, PH = plant height, BRP = primary branches per plant, PDP = pods per plant, SPD = seeds per pod, BM = biomass, GY = grain yield, SW = 100seeds weight.

Table 3. Mean of farmers' preference criteria on faba bean variety selection at Lalibela.

Variety	Farmers criteria						Total	Mean	Rank
	PES	OAP	STS	PS	ER	SS			
Walk	47	33	32	32	60	22	226	37.67	5th
Moti	33	21	22	22	33	65	196	32.67	8th
CS-20DK	33	33	49	30	32	22	199	33.17	7th
Obsie	36	37	34	37	33	37	214	35.67	6th
Dosha	69	69	69	69	46	37	359	59.83	1st
Tumsa	68	66	63	64	26	49	336	56.00	4th
Gora	66	64	58	61	26	65	340	56.67	3rd
Hachalu	69	60	56	64	46	50	345	57.5	2nd
Local	33	21	15	30	33	15	147	24.50	9th

Note: PES = plant Establishment, OAL = Overall performance, STS =Stem strength, PS =pod setting, ER = earliness, SS = Seed size

3.2. Analysis of Agronomic Traits, Yield components and Farmer's Preference at Dehana

Analysis of variance revealed that plant height was significantly ($P \leq 0.01$) affected by faba bean varieties. The maximum height was recorded for Gora, CS-20DK, and Tumsa with mean scores of 98.30 cm, 94.50 cm, 91.37 cm, respectively (Table 4). In line with this finding, Degife and Kiya (2016) reported that variety Gora was the tallest (46.6 cm) followed by variety Gebelcho (46.27 cm). Similarly, the highest number of branches per plant (2.73) was obtained from variety Obsie followed by Hachalu (2.70) and CS-20DK (2.60) varieties, respectively.

The tested varieties showed significant variations for number of pods per plant and number of seeds per pod. The highest number of pods and seeds were scored for CS-20 DK, Hachalu and Tumsa varieties, with the average mean scores of 18.4 & 3.07, 12.7 & 2.73 and 12.47 and 2.73, respectively, but the minimum numbers (10.23 and 2.40) were recorded for the local variety (Table 4). Simultaneously, variety CS-20DK was the highest yielder (2329.17 kg ha^{-1}), followed by Tumsa (1927.08 kg ha^{-1}) and Gora (1890.63 kg ha^{-1}) varieties, whereas the lost yield (1143.66 kg ha^{-1}) was recorded for the local variety (Table 4). Likewise, Degife and Kiya (2016) and Tewodros *et al.* (2015) had reported significant differences in the number of pods and seeds per plant, 100 seed weight, as well as grain yield among the faba bean varieties at Gamo Gofa and North Gonder zones respectively.

In Dehana woreda (district), the production and productivity of faba bean was constrained by the gall-forming disease, with the mean severity ranging from

11.87% to 38.00% among the tested varieties. Likewise, Anteneh *et al.* (2018) reported the highest mean severity (42.14%) of gall-forming disease at Debark district. The highest disease mean severity was scored from Local (38.00%), Dosha (22.87%) and Walki (19.53%) varieties, respectively, but the lowest (11.87%) had scored from Gora variety (Table 5). In line with this result, Teklay et al. (2014) reported the significant differences in gall-forming disease severity among varieties and the importance of this disease in southern Tigray. The mean score revealed that the incidence of gall-forming diseases was significantly different among the tested varieties. The maximum faba bean gall incidence was recorded for the local variety (84.4%), Hachalu (64.5%) and Dosha (45.0 %) varieties, while the minimum incidence was recorded for Moti and Tumsa varieties, with the average incidence of 23.8% and 31.2%, respectively (Table 5). Similarly, Mekuria and Ashenafi (2014) reported maximum disease incidence in Degaga (44.30%), Hachalu (49.99%) and Gebelcho (42.26%) varieties in Agarfa Districts.

3.2.1 Farmers' Variety Evaluation

Three Agricultural development agents, 8 men, and 2 women farmers evaluated the trial using plant establishment, biomass, Stem strength, pod setting, earliness, number of branch per plant as criteria to select promising varieties. CS-20 DK (55.8), Tumsa (53.0) and Gora (52.0) scored the highest values, respectively and the lowest (25.5) was scored for the local variety (Table 6).

Table 4. Mean grain yield and other agronomic traits of faba bean varieties at Dehana.

Variety	DF	PH(cm)	BRP	PDP	SPD	BM(kgha^{-1})	GY(kgha^{-1})	SW (g)
Walki	53	79.67	2.40	11.07	2.67	3291.70	1587.50	53.50
Moti	53	90.30	2.27	10.33	2.73	3361.10	1427.08	62.50
CS-20DK	53	94.50	2.60	18.40	3.07	3000.00	2329.17	51.33
Obsie	53	88.73	2.73	10.50	3.07	3923.60	1798.61	74.83
Dosha	54	85.27	2.13	8.67	2.93	3548.60	1716.67	60.17
Tumsa	56	91.37	2.27	12.47	2.73	4333.30	1927.08	70.67
Gora	51	98.30	2.27	10.77	3.20	3869.80	1890.63	75.83
Hachalu	51	91.00	2.70	12.70	2.73	4739.60	1572.92	64.00
Local	55	82.90	2.07	10.23	2.40	3395.80	1143.66	38.67
Mean	53	89	2.38	11.46	2.84	3718.17	1710.97	61.28
LSD	NS	7.88**	0.41*	1.25**	0.39*	510.5**	163.62**	5.36**
CV	5.31	5.11	9.83	6.31	8.04	7.93	5.53	5.05

Note: NS=non-significant, *= significant, **=highly significant, DM = days to maturity, PH = plant height, BRP = primary branches per plant, PDP = pods per plant, SPD = seeds per pod, BM = biomass, GY = grain yield, SW = 100seeds weight.

Table 5. Average Mean Score of Gall-forming Disease incidence and severity at Dehana

Variety	Mean of incidence (%)	Mean of Severity (%)
Walk	36.4	19.53
Moti	23.8	14.13
CS-20 DK	41.3	19.00
Obsie	40.7	13.47
Dosha	45.0	22.87
Tumsa	31.2	10.43
Gora	36.6	11.87
Hachalu	64.5	14.33
Locale	84.4	38.00

3.3. Analysis of Agronomic Traits, Grain Yield, and Farmer's Preference at Hamusite

Agronomic traits i.e., days to flowering, days to maturity, plant height, number of primary branches per plant, number of pods per plant, number of seeds per pod, Biomass, grain yield and hundred seed weight, were analyzed (Table 7). The varieties significantly ($P \leq 0.05$) varied for days to flowering, with a mean score ranging from 40 days (Dosha) to 44 days (Gora and Walki). This result agreed with Tafere *et al.* (2012) who reported that days to flowering had significantly affected by variety.

Highly significant ($P \leq 0.01$) differences were also observed among varieties for number of primary branches per plant, number of pods per plant, number of seeds per pod and biomass. Likewise, Tafere *et al.* (2012) and Teame *et al.* (2017) reported significant differences for the number of pods and seeds per plant among the faba bean varieties they tested. Mmaximum numbers of pods per plant (16.80) were harvested for Dosha, followed by Walki (14.27) and Hachalu (13.60) varieties, while the lowest (9.20) was obtained from Obsie variety. The highest number of seeds per pod was recorded from Walki, Dosha and Gora varieties, with the mean score of 3.60, 3.53 and 3.30, respectively whereas; the minimum number of seeds per pod was obtained on Local variety. The tested varieties significantly ($P \leq 0.01$) varied for hundred seed weight, indicating the genetic variation among varieties. Of all the tested varieties, Obsie (68.50g, Tumsa (63.17g) and Gora (61.75g) produced heaviest seeds, respectively.

Table 6. Mean of farmers' selection criteria and ranking of genotypes at Dehana.

Variety	Farmers criteria						Total	Mean	Rank
	PES	BM	STS	PS	ER	BR			
Walk	46	44	40	38	44	22	234	39	7th
Moti	33	26	22	22	33	46	182	30.3	8th
CS-20 DK	59	59	58	59	56	44	335	55.8	1st
Obsie	48	46	48	48	40	52	282	47	5th
Dosha	54	50	52	50	44	44	294	49	4th
Tumsa	58	56	58	56	48	42	318	53	2nd
Gora	54	52	54	50	46	56	312	52	3rd
Hachalu	48	50	42	42	42	46	270	45	6th
Local	33	22	20	30	33	15	153	25.5	9th

Note: PES = plant Establishment, BM = biomass, STS =Stem strength, PS =pod setting, ER =earliness, BR = branch number

Analysis of variance revealed that there was highly significance difference ($P \leq 0.01$) among the tested varieties for grain yield. The maximum yield (2197.9kgha^{-1}) was harvested from Dosha variety, while Local variety was the lost yielder (1687.50kgha^{-1}). Walki and Hachalu varieties were the 2nd and 3rd high yielder with 2079.70kgha^{-1} and 2031.30kgha^{-1}, respectively. The result was in line with Tewodros et al. (2015)who reported that the highest yield was obtained on varieties Hachalu (2429.5kgha^{-1}) and Dosha (2226.30kgha^{-1}).

Table 7. Mean grain yield and other agronomic characters of faba bean varieties at Hamusite

Variety	DF	DM	PH(cm)	BRP	PDP	SPD	BM(kgha^{-1})	GY(kgha^{-1})	SW (g)
Walki	44	79	96.90	3.00	14.27	3.60	2088.61	2079.70	47.67
Moti	41	77	104.40	2.60	12.00	3.27	2087.64	1750.00	60.25
CS-20 DK	43	76	102.10	3.30	12.80	3.13	2086.39	1756.90	42.67
Obsie	43	81	99.20	2.93	9.20	3.00	2087.35	1868.10	68.50
Dosha	40	81	99.33	2.73	16.80	3.53	2088.6	2197.90	58.50
Tumsa	43	77	105.53	3.70	12.80	3.20	2089.54	1729.20	63.17
Gora	44	77	107.10	2.73	10.20	3.30	2087.72	1899.30	61.75
Hachalu	43	81	97.40	2.40	13.60	3.13	2089.11	2031.30	52.00
Local	40	77	92.10	2.27	9.83	2.53	1819.93	1687.50	32.67
Mean	42	78	100.45	2.85	11.72	3.26	2058.32	1901.43	54.13
LSD	2.67*	NS	NS	0.49**	2.16**	0.39**	33.32**	309.45**	8.10**
CV	3.67	5.45	5.31	9.87	10.62	6.98	4.94	9.40	8.62

Note: NS=non-significant, *= significant, **=highly significant, DM = days to maturity, PH = plant height, BRP = primary branches per plant, PDP = pods per plant, SPD = seeds per pod, BM = biomass, GY = grain yield, SW = 100seeds weight.

3.3.1. Farmer's Variety Evaluation and Criteria

Three Agricultural development agents, 8 men, and 2 women farmers were invited to select the promising varieties. Dosha, Walki, and Hachalu have been selected as the promising varieties by scoring 45.6, 42.0 and 41.5 values, respectively, but the lowest (25.5) value was scored by Local variety. In line to this finding Wondimu (2016) and Tafere et al. (2012) stated that Dosha was the 1st ranked variety by farmers selection. The same variety had better performance and was found to be promising. It is obvious that farmers demonstrated the ability to select well adapted and preferred varieties, under their circumstances, using their own criteria.

4. Conclusion and Recommendation

Incorporating farmers' preferences in the selection of varieties in the breeding process may increase the adoption rate of new varieties. Farmers' exposure to evaluate and select new varieties provides an advantage to exploit their potential knowledge of identifying adapted varieties that best meet their interests.

The interaction of researchers and farmers will also help to design research objectives, to overcome rejection of varieties developed by researchers alone, enhances the acceptance of varieties and reduces costs associated with variety development. The present investigation showed that the promising variety Dosha gave the highest grain yield and showed best performance in other agronomic traits, than the tested varieties at both Lalibela and Hemusite. Similarly, farmers selected Dosha as the promising and adapted variety. Whereas, variety CS-20DK gave the highest grain yield and showed better performance at Dehana. The same varieties had better performance and selected as top ranking according to farmers perception.

The current selection process also demonstrated that farmers were capable of selecting important traits for grain yield and identifying superior varieties adapted to their locality. Totally, PVS was effective

and reliable for identifying appropriate cultivars through a partnership with resource-poor farmers. Dosha had recommended for Lalibela, Hemusite and related Agro-ecologies, while CS-20DK had recommended for Dehana and related Agro-ecologies. Other faba bean gall diseases management methods and resistant variety development activities should be done to increase the production and productivity of faba bean at Dehana.

Table 8. Mean of farmers' selection criteria and ranking of varieties at Hamusite.

Variety	Farmers criteria						Total	Mean	Rank
	PES	OAL	STS	PS	ER	PH			
Walki	47	46	46	47	40	26	252	42.00	2nd
Moti	30	25	22	26	33	48	184	30.67	6th
CS 20 DK	30	28	25	26	32	22	163	27.17	7th
Obsie	40	38	34	37	36	37	222	37.00	4th
Dosha	49	50	47	50	38	40	274	45.67	1st
Tumsa	28	26	26	22	26	46	174	29.00	8th
Gora	32	32	30	32	38	48	212	35.33	5th
Hachalu	46	44	40	44	33	42	249	41.50	3rd
Local	33	21	15	30	33	15	147	25.50	9th

Note: PES = plant establishment, OAL = Overall performance, STS =Stem strength, PS =pod setting, ER = earliness, PH = plant height

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