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Short communication

Selection of garlic genotypes for yield, quality and better storage

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ABSTRACT

Garlic after harvest get damaged due to weight loss and infestation with different microbes and during storage. The present study was undertaken with the objective of screening 19 superior high yielding genotypes for better storage quality. Genotype G-282 had the highest bulb weight though G-176, G-189, G-324 and G-41 had good bulb size and quality. Genotype G-192 had the minimum PLM (3.67%), while G-200 had minimum storage loss after three month storage (4.5%).

Key words: Garlic genotypes, quality, storage, yield.

Among the spices grown in India, garlic (*Allium sativum* L.) is important bulbous crop and widely cultivated *Allium* throughout country. It is consumed in various ways by almost all the sections of the societies and highly placed for its flavour enhancing capacity (Roy and Chakraborti, 4). Garlic has higher nutritive values than other bulbous crops, (Pandey, 2) and can also be used for preparation of pickle (Pandey and Singh, 3). The average productivity of garlic in India is 5.51 tonnes/ha, which is very low when compared to other garlic growing countries. The lack of high yielding and better storage varieties of garlic are the main constraints in limiting the production and productivity.

Garlic exhibits greater susceptibility to agro-techniques and environmental condition and possesses a wide range of variability on bulb traits and yield attributes as well as the storability in spite of being vegetatively propagated crop. To meet out the domestic as well as export requirement, selection of suitable genotypes for growing under different agro-climatic conditions and better self-life is required. Sprouting, physiological loss of weight (PLW) and rotting are the main causes of loss during storage. These losses depend on the genotype, type of storage and weather conditions. Generally in garlic within two months storage no sprouting occurs but increase rapidly thereafter. Therefore, it is essential to increase the shelf-life of garlic without deterioration of its quality. The National Horticultural Research and Development Foundation collected a large number of germplasm from within the country and abroad and evaluated their performance at its Regional Research Station, Karnal and selected 19 lines from more than 300 germplasm. An experiment was conducted to identify the superior clones under ambient storage condition to minimize the price fluctuation during the shortage of garlic.

Nineteen advance lines including four checks Yamuna Safed (G-1), Agrifound White (G-41), Yamuna Safed-2 (G-50) and Yamuna Safed-3 (G-282) selected from more than three hundred germplasm evaluated at this centre. Planting of cloves of selected lines were done every year in first fortnight of October in bed of size 3.0 m × 1.5 m. Recommended agro-practices were followed to ensure a healthy crop growth and development. Irrigation along with inter-cultural operations were done as and when required. The climate of Karnal is subtropical and minimum and maximum temperature ranging between 5°C to 42°C respectively. The harvesting was done as per bulb maturity from 28/03/2007 to 02/04/2007 in 2006-07 while in 2007-08 harvested on 26/03/2008 to 12/04/2008. After proper field curing neck cutting and well cured, representative bulbs of these advance lines were kept in storage on 08/06/2007 and 06/05/2008 for four months for two years, so as to identify superior clones for storage under ambient conditions in perforated plastic crates.

Both field as well as storage studies were carried out in randomized block design with three replications. Observations were recorded on ten randomly selected plant in each lines for all the traits, *viz.,* plant height (cm), leaves per plant, neck thickness (cm), bulb diameter (cm), bulb size index (cm^2), weight of 20 bulbs (kg), equatorial clove diameter (cm), clove size index (cm^2), weight of 50 cloves (g), number of cloves per bulbs, bolting (%), total soluble solids (%), dry matter content (%), gross yield (q/ha), marketable yield (q/ha), occurrence disease, insect pest, storage losses due to sprouting, physiological loss of weight (PLW), rotting

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Table 1. Pooled mean performance of garlic advance lines.

Advance line	Gross yield (q/ha)	Marketable yield (q/ha)	Wt. of 20 bulbs (kg)	Bulb dia. (cm)	Bulb size index (cm^2)	No. of cloves/ bulb	Cloves dia. (cm)	Clove size index (cm^2)	Wt. of 50 cloves (g)	Neck thickness (cm)	Plant height (cm)	Leaves/ plant	TSS (%)	DM (%)
G-4	147.68	137.35	0.66	4.45	13.92	40.40	1.09	2.89	51.00	1.45	88.38	7.80	36.92	39.01
G-176	147.12	137.30	0.68	4.61	14.07	32.12	1.09	2.80	52.50	1.45	89.89	8.07	36.87	38.84
G-189	156.38	141.20	0.70	4.62	15.50	35.82	0.96	2.56	53.34	1.51	92.07	7.95	38.87	40.82
G-192	143.66	136.89	0.69	4.65	14.32	40.09	1.06	2.67	48.17	1.51	91.25	8.22	37.02	39.04
G-200	130.23	120.68	0.63	4.41	12.98	30.12	1.19	3.11	55.50	1.49	94.23	7.53	39.25	41.10
G-222	137.90	116.19	0.63	4.53	13.38	32.95	1.21	2.85	55.67	1.43	92.88	7.64	38.35	40.21
G-255	132.58	121.75	0.67	4.52	13.52	40.07	1.14	2.72	48.83	1.51	94.91	7.72	39.15	40.99
G-264	144.69	136.10	0.66	4.41	13.84	36.92	1.07	2.49	46.00	1.49	94.16	8.67	38.08	40.16
G-302	114.76	95.19	0.65	4.61	14.58	25.17	1.25	3.40	72.17	1.54	90.98	7.69	37.72	39.83
G-304	146.61	132.80	0.67	4.54	14.06	39.52	1.18	2.77	50.50	1.49	94.58	7.87	38.99	40.95
G-305	139.57	129.16	0.60	4.51	14.70	28.92	1.36	2.89	59.17	1.50	86.35	8.27	39.19	41.14
G-324	159.88	142.95	0.70	4.84	15.55	36.60	1.18	3.09	58.83	1.54	100.2	8.73	39.00	41.06
G-366	137.02	117.54	0.66	4.35	14.06	26.30	1.32	3.39	67.67	1.43	94.44	7.33	38.29	40.38
G-368	107.94	97.02	0.63	4.23	13.47	33.55	1.22	2.99	54.50	1.56	99.29	8.65	36.70	38.77
G-369	99.75	86.59	0.57	4.20	11.88	29.55	1.21	3.20	61.50	1.49	88.76	7.77	37.17	39.14
G-1(C)	143.75	127.22	0.67	4.64	14.63	40.37	0.99	2.51	50.00	1.47	93.92	8.15	38.58	40.12
G-41(C)	169.98	158.40	0.71	4.76	16.95	35.09	1.14	3.20	58.17	1.48	88.93	8.38	38.45	40.38
G-50(C)	136.98	125.29	0.64	4.39	13.26	40.29	1.08	2.85	49.00	1.43	90.38	7.97	38.47	40.44
G-282(C)	141.79	118.36	0.72	4.66	15.01	17.54	1.62	4.17	95.00	1.52	94.00	8.37	37.33	39.49
Min.	99.75	86.59	0.57	4.23	11.88	17.54	0.96	2.49	48.17	1.43	86.35	7.33	36.70	38.77
Max.	169.98	158.40	0.72	4.84	16.95	40.40	1.62	4.17	95.0	1.56	100.2	8.73	39.25	41.14
CD at 5%	23.09	26.28	0.06	0.32	0.95	4.69	0.13	0.25	7.08	NS	5.50	0.42	1.43	1.34

and total loss recorded monthly for four months. Data of two consecutive years for both field and storage are pooled separately and analyzed to identify the high quality planting materials for development of high yielding, processing as well as good keeping quality type varieties.

The data presented in Table 1 revealed that the highest and significant plant height (100.20 cm) and leaves per plant (8.73) was noted for G-324. Both traits ranged between 86.35-100.23 cm and 7.33-8.73 respectively. Minimum neck thickness (1.43 cm) was noted for G-222, G-366 and check G-50, but it showed non-significant differences. The traits, bulb diameter and bulb size index showed the highest and significant differences (4.84 cm) and (16.95 cm^2) in lines G-324 and check G-282 respectively and was at par with lines G-176, G-189, G-192, G-222, G-255, G-302, G-304, check G-1, G-282 and G-41, in reference to bulb diameter. The weight of 20 bulbs and weight of 50 cloves ranged between (0.63-0.72 g) and (48.17-95.0 g), the maximum significant weight of bulb (0.72 g) and cloves weight (95.0 g) was noted in check G-282, which was at par with G-176, G-189, G-324 and G-41 regarding 20 bulbs weight. It is reported that increase in bulb weight was associated with increase in plant height, leaves per plant, bulb diameter, bulb size index number of cloves per bulbs and cloves weight. This is in consonance with the findings of Ahmed and Hoque (1), and Thompson and Kelly (6). The highest and significant clove diameter (1.62 cm) and clove size index (4.17 cm^2) was observed for check variety G-282 and was higher than all lines. The lowest diameter of clove (0.96 cm) and clove size index (2.49 cm^2) was noted in G-189 and G-264, respectively. The similar yield attributing results as reported by Singh and Chand (5), while comparing some selected varieties.

The number of cloves per bulb ranged from 17.54–40.40. Minimum significant (17.54) cloves per bulb were noted for G-282 and highest clove per bulb (40.40) was noted in G-4. Total soluble solids ranged higher from (39.25%) to as low 36.70%. Higher TSS was noted in G-200, which was at par with G-189, G-222, G-255, G-264, G-304, G-305, G-323, G-366 and check G-1, G-41 and G-50. Higher dry matter (41.14%) was noted in G-305, which was at par with

Table 2. Pooled storage performance of garlic advance lines.

Advance line	Gross yield (q/ha)	Marketable yield (q/ha)	After one month				After two months				After three months				After four months			
			Sprouting (%)	Decay loss (%)	PLW (%)	Total loss (%)	Sprouting (%)	Decay loss (%)	PLW (%)	Total loss (%)	Sprouting (%)	Decay loss (%)	PLW (%)	Total loss (%)	Sprouting (%)	Decay loss (%)	PLW (%)	Total loss (%)
G-4	147.68	137.35	0.00	0.00	1.33	1.33	0.00	0.00	2.50	2.50	0.00	0.00	4.17	4.17	0.00	0.00	5.84	5.84
G-176	147.12	137.30	0.00	0.00	1.67	1.67	0.00	0.00	2.50	2.50	0.00	0.00	3.84	3.84	0.00	0.00	6.00	6.00
G-189	156.38	141.20	0.00	0.00	1.50	1.50	0.00	0.00	3.00	3.00	0.00	0.00	4.00	4.00	0.00	0.00	6.33	6.33
G-192	143.66	136.89	0.00	0.00	1.00	1.00	0.00	0.00	2.50	2.50	0.34	0.00	5.34	5.67	0.34	0.00	7.17	7.50
G-200	130.23	120.68	0.00	0.00	2.17	2.17	0.00	0.00	3.33	3.33	0.00	0.00	3.67	3.67	0.00	0.00	4.50	4.50
G-222	137.9	116.19	0.00	0.00	2.17	2.17	0.00	0.00	3.17	3.17	0.34	0.00	5.84	6.17	0.34	0.00	7.50	7.84
G-255	132.58	121.75	0.00	0.00	1.84	1.84	0.00	0.00	3.00	3.00	0.00	0.00	4.34	4.34	0.00	0.00	5.83	5.83
G-264	144.69	136.10	0.00	0.00	1.50	1.50	0.00	0.00	3.00	3.00	0.00	0.00	4.42	4.42	0.00	0.00	6.33	6.33
G-302	114.76	95.19	0.00	0.00	3.17	3.17	0.00	1.67	4.67	6.34	0.67	1.67	7.34	9.67	0.67	1.67	9.67	12.00
G-304	146.61	132.80	0.00	0.00	1.83	1.83	0.00	0.00	3.34	3.34	0.50	0.00	5.84	6.34	0.50	0.00	8.17	8.67
G-305	139.57	129.16	0.00	0.00	1.50	1.50	0.00	0.00	3.00	3.00	0.00	0.00	4.84	4.84	0.00	0.00	7.17	7.17
G-324	159.88	142.95	0.00	0.00	1.83	1.83	0.00	0.00	2.84	2.84	0.00	0.00	5.50	5.50	0.00	0.00	7.34	7.34
G-366	137.02	117.54	0.00	0.00	2.34	2.34	0.00	0.00	3.17	3.17	0.00	0.00	6.00	6.00	0.00	0.00	6.84	6.84
G-368	107.94	97.02	0.00	0.00	2.67	2.67	0.00	0.67	3.83	4.50	0.00	0.67	5.67	6.33	0.00	0.67	8.00	8.67
G-369	99.75	86.59	0.00	0.00	2.84	2.84	0.00	0.00	6.00	6.00	0.00	0.00	10.17	10.17	0.00	1.50	13.75	15.25
G-1 (C)	143.75	127.22	0.00	0.00	2.00	2.00	0.00	0.00	4.00	4.00	0.00	0.00	6.33	6.33	0.00	0.00	8.17	8.17
G-41 (C)	169.98	158.40	0.00	0.00	2.50	2.50	0.00	0.00	5.67	5.67	0.00	0.00	7.67	7.67	0.00	0.00	12.17	12.17
G-50 (C)	136.98	125.29	0.00	0.00	2.17	2.17	0.00	0.00	3.33	3.33	0.00	0.00	5.50	5.50	0.00	0.00	6.50	6.50
G-282 (C)	141.79	118.36	0.00	0.00	2.50	2.50	0.00	0.84	4.84	5.67	0.00	0.84	8.84	9.67	0.00	0.84	11.59	12.42
CD at 5%	23.09	26.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.59	4.66

G-189, G-222, G-255, G-264, G-324 and check G-41 and G-50. It is suggested that, the lines which have high total soluble solids and dry matter content that can be used for processing and storage purpose. These variations among the characters mentioned above could be utilized by the plant breeder for the improvement of desired traits. The highest gross yield (169.98 q/ha) and marketable yield (158.40 q/ha) was noted for check variety G-41, which was at par with G-4 (147.68 q/ha) (137.35 q/ha), G-176 (147.12 q/ha) (137.30 q/ha), G-189 (156.38 q/ha) (141.20 q/ha), and G-324 (159.88 q/ha) (142.95 q/ha). These ranges in yield showed that the lines which have high gross as well as marketable yield can be utilized in crop improvement for higher production. The range of thrips incidence (91.67-100%) and intensity (5.95-7.95%) and stemphylium blight disease incidence (53.74-63.48%) and intensity (9.53-14.40%) was noted, but it showed non-significant difference, it is suggested that no single line showed resistant to diseases and insect pest.

The storage data presented in Table 2 revealed that after one month of storage no sprouting and decay were observed for all the lines. The line G-192 showed minimum physiological loss of weight and total loss (1.00%), but it did not show significant differences. A non-significant difference was observed for all traits after two months of storage. After three months of storage all lines showed no sprouting except G-192, G-302 and G-304, only three lines, *viz.* G-304 (1.67%), G-368 (0.67%) and check G-282 (0.84%) showed decay loss. The minimum physiological loss of weight and total loss (3.67%) was noted for G-200, but it indicated non-significant differences. After four months of storage the sprouting and decay loss showed non-significant differences. The minimum and significant physiological loss of weight and total loss (4.50%) was noted for G-200, and which was at par with G-4, G-176, G-189, G-222, G-255 and G-324. It is suggested from the study, the lines G-200, G-4 and G-255 can be used for development for good quality planting material for storage.

The line G-200 showed high total soluble solids and also gave minimum total losses after four months of storage, it means the lines which are having high total soluble solids, can be stored for long duration. It is clear from the field and storage data that the lines G-324 are G-189 can be used for improvement in garlic variety and G-200 for development in highly durable planting material with minimize the storage losses.

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