

Short Communication

CH-52: Chilli hybrid suitable for low tunnel cultivation

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Chilli (*Capsicum annuum* L.) is an important spice-cum-vegetable crop of the family *Solanaceae*. India is the largest producer, consumer and exporter of chillies in the world. Generally, the transplanting of chilli is done in February-March in North Indian plains and crop ends by October-November. However, there are some areas in Punjab where the chilli crop is transplanted in mid November under low tunnels to get early crop and this crop ends in June which is followed by late paddy varieties/Basmati crop. Thus, two crops in a rotation is practiced by transplanting chilli under low tunnel. The major bottleneck in this low tunnel cultivation is non-availability of suitable variety/hybrid. Therefore, the breeding program was initiated to develop CGMS lines in 2009 (Meena et al. 2018). From the developed 17 CGMS lines, the line CMS463D13A (renamed as MS13A) was used as female parent to cross with IS-261 to develop hybrid CH-52 which is suitable for low tunnel cultivation. Thus, Punjab Agricultural University, Ludhiana has recommended his first CGMS based chilli hybrid 'CH-52' for commercial cultivation in the state in 2021.

The trials were conducted from 2016-17 to 2019-20 at PAU, Ludhiana by taking newly developed F₁ hybrid CH-52 along with commercial check 'Veerji' (Nunhems Seeds Private Limited, India). During 2018-19, the trials were conducted at other locations i.e. at Bathinda, Ferozepur, Gurdaspur and SBS Nagar in addition to PAU, Ludhiana in randomized complete block design with 3 replications. During 2019-20, on farm testing (adaptive research trials) were conducted on 45 locations of the state. The data was recorded for total yield (q/ha), days from transplanting to first harvest, fruit weight (g), fruit length (cm), fruit width (mm), pericarp thickness (mm), plant height (cm), plant spread (cm), number of seeds per fruit, 1000 seed weight (g), dry matter (%), colouring

matter (ASTA units), Vitamin C of green fruit (mg/100g), oleoresin (%), capsaicin (%) in green fruit and red fruit, fruit rot (% disease index), root gall index (0-5), leaf curl virus disease reaction, whitefly population per 3 leaves per plant and thrip population per cluster per plant. The disease data on fruit rot, root gall index and leaf curl virus disease reaction under artificial conditions were recorded as per Bansal and Grover (1969), Taylor and Sassor (1978) and Baneerjee and Kalloo (1987), respectively whereas the data on whitefly population and thrip population was recorded under natural epiphytotic conditions in non-sprayed conditions. However, the performance of 'CH-52' and checks are based on the overall mean obtained from the 3 levels of evaluation trials. The data collected at PAU and other locations were subjected to analysis to calculate least square differences; adaptive trials from 45 locations were averaged which are as follows:

Performance for total yield: In local research trials, first picking of CH-52 was possible 112 days after transplanting (Table 3) whereas it was 108 days in Veerji. For total yield, CH-52 recorded average yield of 241.81 q/ha (Table 1) in local research trials which was approximately 7.88% higher than check Veerji. In multilocation trials, fruit yield of CH-52 was recorded 251.88 q/ha (Table 2) which was 8.86% more than check Veerji (231.37q/ha). Based on the mean performance of 45 on-farm trials, CH-52 recorded an average yield of 270.75q/ha which was 27.90% more than check Veerji (211.69q/ha). Overall, CH-52 recorded an average yield of 254.81q/ha (Table 2) which was 14.58% more than check Veerji (222.39q/ha).

Performance for fruit traits: Based on the research trials (Table 3), average fruit weight of CH-52 was 5.98g which was higher than the hybrid Veerji (3.42g) which contributes to its significant fruit yield. The fruit length and fruit width of CH-52 was 9.77cm and 11.32mm which was significantly higher than check Veerji (7.31 cm and 9.84mm). This depicts that the hybrid is longer and

thin than the check hybrids which are the desirable traits for the consumer. The pericarp thickness is 1.11mm in CH-52 which was more than check Veerji (0.92mm). Thicker pericarp is the desirable trait associated with longer shelf life and high transportation ability. Dhaliwal et al. 2013, 2015 also observed that the hybrid with thicker pericarp, longer fruit and higher weight are the contributing traits of higher yield, longer shelf life and high transportation ability. The plant height and plant spread of all the test entries were also recorded. It was found that the hybrid CH-52 has plant height (102.17cm) higher than Veerji (88.35cm), while, plant spread (74.57cm) was also recorded more than check hybrid Veerji (56.48cm).

Performance for seed traits: Seed traits are very important from traders' point of view. It was found that the hybrid CH-52 (63.94) has more number of seeds per fruit when compared with check hybrid Veerji (44.72). Similarly, 1000 seed weight of CH-52 (6.09g) is higher than the check hybrid Veerji (4.91g). More number of seeds per fruit and more seed weight not only contributes to yield but also responsible for longer shelf life and better transportation ability to distant markets. Dhaliwal et al. 2015 also reported that higher seed weight is desirable trait for distant transportation.

Performance for quality traits: The hybrid CH-52 recorded dry matter content of 24.70% while it was 21.45% for hybrid Veerji (Table 2). The colouring matter in CH-52 was 180.72 ASTA units whereas it was 144.34 ASTA units in Veerji. Vitamin C content of CH-52 was 130.91mg/100g fresh weight in green fruits. The oleoresin content of CH-52 (15.77%) was higher than the check hybrid Veerji (13.75%). On the basis of capsaicin content in red fruits, CH-52 (0.86%) was categorized as pungent whereas Veerji (0.69%) as moderately pungent. Dhaliwal et al. (2015) also observed same results after evaluating different chilli hybrids for quality traits.

Table 3: Performance of chilli hybrids for horticultural and quality traits (average of 2017-18, 2018-19 and 2019-20)

Trait	CH-52	Veerji (Check)	CD at p=0.05
Days from transplanting to first harvest	112	108	2.34
Fruit weight (g)	5.98	3.42	0.81
Fruit length (cm)	9.77	7.31	1.01
Fruit width (mm)	11.32	9.84	0.14
Pericarp thickness (mm)	1.11	0.92	0.13
Plant height (cm)	102.17	88.35	12.80
Plant spread (cm)	74.57	56.48	8.90
Number of seeds per fruit	63.94	44.72	6.15
1000 seed weight (g)	6.09	4.91	0.57
Dry matter (%)	24.70	21.45	3.76
Colouring matter (ASTA units)	180.72	144.34	10.38
Vitamin C mg/ 100g (Green fruit)	130.91	113.99	9.03
Oleoresin (%)	15.77	13.75	0.92
Capsaicin in green fruit (%)	0.55	0.42	0.03
Capsaicin in red fruit (%)	0.86	0.69	0.04

Reaction against insect-pests and diseases: Upon screening under artificial conditions, CH-52 was found moderately resistant (Table 4) to fruit rot (18.42% and 22.79%) whereas Veerji (31.31%) was found susceptible. On screening for root knot nematodes (Table 4) in sick plot, the hybrid CH-52 (1.84) was moderately resistant whereas the hybrid Veerji (3.20) was found susceptible. For artificial screening against leaf curl virus (Table 4), CH-52 and Veerji were moderately resistant. Similar results of leaf curl virus resistance and root knot nematodes were reported by Kaur et al. (2018). The whitefly and thrips population per plant were recorded under natural conditions (Table 4). It was found that all the test entries recorded comparable score for whitefly and thrip population per plant.

Based on the above results, the hybrid CH-52 was released for commercial cultivation in the state by State Varietal Approval Committee for Horticultural Crops on January 07, 2021. The salient features of the hybrid

Table 1: Performance of chilli hybrids for total yield (q/ha) under low tunnel cultivation at PAU, Ludhiana

Hybrid	2016-17	2017-18	2018-19	2019-20	Mean	Percent increase/ decrease over check
CH-52	238.00	234.50	246.75	248.00	241.81	-
Veerji (C)	224.13	219.00	228.38	225.00	224.13	+07.88
CD at P=0.05	19.8	11.5	16.7	19.89	12.45	-

Table 2: Overall performance of chilli hybrids for total yield (q/ha) under low tunnel cultivation at On-station, multilocation and On-farm trials

Hybrid	On station Research Trials (4 years)	Multilocation Research Trials (5 locations)	On-farm Trials (45 locations)	Mean	Percent increase/ decrease over check
CH-52	241.81	251.88	270.75	254.81	-
Veerji (C)	224.13	231.37	211.69	222.39	+14.58
CD at P=0.05	12.45	5.61	-	-	-

Table 4: Reaction of chilli hybrids against important diseases (under artificial inoculation conditions) and insect-pests (under natural conditions) #

Hybrids	Fruit rot (Mean PDI*)	Root gall index**	Disease severity scale for Leaf curl virus***	Whitefly population per 3 leaves/ plant	Thrip population per cluster per plant
CH-52	18.42	1.84	31	1.64	2.37
Veerji (Check)	31.31	3.20	38	1.71	2.51

#average of 2018-19 and 2019-20

*0-No disease symptoms, 1: upto 10% (Resistant), 2: 11% to 25% (Moderately Resistant), 3:26 % to50% (Susceptible), 4: 51 % to 100% (Highly Susceptible)

** 0: Immune, 0.1-1: Resistant, 1.1-2.0: Moderately resistant, 2.1-3.0: Moderately susceptible, 3.1-4.0: Susceptible, 4.1-5.0: Highly susceptible

***Scale: 0- Symptomless, 1- Highly Resistant (upto 5%), 2-Resistant (6-25%), 3-Moderately Resistant (26-50%), 4-Moderately Susceptible (51-75%), 5- Susceptible (75-100%)

are: CH-52 is a hybrid between MS-13A x IS-261. The plants are dark green, spreading and tall. First picking is possible 112 days after transplanting. The fruits are long (9.8cm), thin skinned, pendent, borne singly, deep green in colour when immature and deep red on maturity. The fruits are pungent (0.9% capsaicin) and high in dry matter (25%). The hybrid is moderately resistant to leaf curl virus, fruit rot and root knot nematodes. The hybrid is suitable for cultivation under low tunnel and gives average yield of 255 q/ha.

References

- Banerjee MK and Kalloo MK (1987) Sources and inheritance of resistance to leaf curl virus in *Lycopersicon*. Theor Appl Genet 73:707-10.
- Bansal RD and Grover RK (1969) Reaction of chilli (*Capsicum frutescens*) varieties to *Colletotrichum capsici*. J Res Punjab Agric Univ 6: 345-348.
- Dhaliwal MS, Jindal SK and Cheema DS (2013) Punjab Sindhuri and Punjab Tej: New varieties of chilli. J Res Punjab Agric Univ 50 (1 & 2): 79-81.
- Dhaliwal MS, Jindal SK and Cheema DS (2015) CH-27: A multiple disease resistant chilli hybrid. Agric Res J 52 (4):127-129.
- Kaur S, Kang SS, Sharma A, Jindal SK and Dhaliwal MS (2018) Evaluation for hot pepper germplasm for multiple disease resistance against root knot nematode and viruses. Indian J Plant Genet Resour 31(3): 243-250.
- Meena OP, Dhaliwal MS and Jindal SK (2018) Development of cytoplasmic male sterile lines in chilli (*Capsicum annum* L.) and their evaluation across multiple environments. Breeding Sci 68 (4): 404-412.
- Sharma A, Jindal SK and Thakur H (2018) Phenotypic classes of leaf curl virus disease severity for nursery screening in chilli pepper. Pl Dis Res 33(1): 99-103.
- Taylor AL and Sasser JN (1978) Biology, identification, and control of root-knot nematodes (*Meloidogyne species*). Coop Publ Dep Plant Pathol, North Carolina State Univ, and US Agency Intl Dev Raleigh, NC. P: 111.