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KPCH -1: A High Yielding Parthenocarpic Cucumber Hybrid for Protected Cultivation

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In the present scenario of adverse climatic conditions existing all over the world, protected cultivation stands as the most suitable way to maintain quality and increase the productivity of vegetable crops. Cultivation under protected structures ensures better yield compared to open field conditions and it also helps in year-round cultivation of most of the crops. Being a high value crop with huge demand, salad cucumber (*Cucumis sativus* L.) is highly suitable and profitable for growing under polyhouse conditions. Parthenocarpy is one of the most preferred traits in cucumber which makes it more ideal for protected cultivation. Due to association of parthenocarpy with gynoecious trait parthenocarpic varieties or hybrids often yield higher than conventional seeded cultivars. Since parthenocarpic fruits are seedless, the energy utilized for seed development in traditional cultivars will be used for more fruit production in these kinds of hybrids instead of using it for seed formation and development. Eventhough, it is highly preferable and profitable to grow parthenocarpic cucumber hybrids under protected conditions, its cultivation is highly limited due to unavailability of suitable lines from public sector and very high cost of seeds developed by private sector. Breakdown of gynoecy and parthenocarpy under high temperature conditions is another subject of concern and due to all these reasons development of stable parthenocarpic lines stands as one of the most important breeding objectives of cucumber.

Development of KPCH-1

Despite the adoption of parthenocarpic cucumber cultivation in protected structures, limited efforts have been made in the public sector to develop varieties and hybrids suitable for such environments. A project initiated in 2011 at the Department of Vegetable Science, Kerala Agricultural University, aimed to develop F1 hybrids suitable for polyhouse cultivation in cucumber. Through sib mating, true breeding parthenocarpic inbred lines were generated, and F1 hybrids were developed by crossing the most stable lines. Among these hybrids, KAU Parthenocarpic Cucumber Hybrid-1 (KPCH-1) stood out, showing superiority over commercial

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hybrids in terms of fruit yield, earliness, and tolerance to downy mildew, a prevalent disease in Kerala's naturally ventilated polyhouses.

KPCH-1, being a gynoecious line, produces only female flowers, and being parthenocarpic, all flowers develop into fruits without pollination. Fruits are dark green weighing about 240 gms and 20 cm long and can be stored for up to a week at room temperature. Per plant yield in KPCH-1 is about 4.21 kg and on an average each plant produces about 24 fruits. KPCH-1 was notified for Kerala by the Central Seed Committee in 2019 and this is the only public sector parthenocarpic cucumber hybrid notified in India.

In a multi-locational trial of KPCH-1, conducted along with four other superior public sector cucumber hyrids *viz*., DGCH- 31, DGCH-40, PCUCH-3 and PCUCH-5 at 15 different locations including IIHR, Durgapura, Srinagar, Solan, Sabour, Ludiana, IARI, Rahuri, Parbhani, IIVR, Palampur, Jabalpur, Vellanikkara, Pantnagar and Ranchi, KPCH-1 performed better at three centres *viz*., Srinagar, Solan and IIHR when compared to other public sector hybrids tested, with yield of 349.47 q/ha, 320 q/ha and 277.4 q/ha respectively. At IARI, performance was found to be on par with other best performing hybrids. Among all the hybrids tested at fifteen centres, highest yield was recorded for KPCH-1 at Srinagar (Table 2). In multi-locational trials, KPCH-1 outperformed other public sector cucumber hybrids at several centers across India, demonstrating its pan-Indian superiority and potential to replace costly private sector cucumber hybrids due to its high yield and cost-effective seed availability (Rs. 1/seed).

Table 1: Characteristics of KPCH-1

Character	**Mean values**
Days to first harvest	54.13
Fruits/ plant	24.50
Yield/plant (Kg)	4.21
Parthenocarpy (%)	76.69
Downy mildew PDI (%)	10.80
Crispness/ texture	8.00 ± 0.33
Sex form	Parthenocarpic gynoecious

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KPCH-1 raised in polyhouse

Fruits of KPCH-1

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Sl. No	Entry	IIHR	Durgapura	Srinagar	Solan	Sabour	Ludhiana	IARI	Rahuri	Parbhani	IIVR	Palampur	Jabalpur	Vellanikkara	Pantnagar	Ranchi
1	DGCH-40, IARI NewDelhi	229.5	112.25	311.47	250.4	119.1	153.75	221	159.27	144.72667	130	265.95333	195.045	138.5	142.96	48.08
2	PCUCH-5 , GBPUAT, Pantnagar	175.6	66.2	339.64	291.4	142.06	102.667	223	121.39	149.48667	88.7	254.84	204.995	103.4	188.44	199.4
4	PCUCH-3, GBPUAT, Pantanagar	154.9	0	0	252.5	129.3	0	120	136.46	130	75	0	0	0	0	0
5	KPCH-1, KAU, Vellanikkara	277.4	76.4	349.47	320	113.22	58.8333	219	128.54	145.19	45.5	179.89333	171.62	106.9	151.25	46.58
6	DGCH-31, IARI NewDelhi	132.8	0	155	272.9	135.2	180	148	104.82	178.785	161	255	134.05	0	162.57	21.08

Table 2: Mean yield of cucumber hybrids (q/ha) (Mean of three years 2016-2019: AICVIP data)

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Cultivation techniques of KPCH-1

Planting

Salad cucumbers can be grown year-round in protected structures, with the optimal planting time being from the last week of October to the first week of November. Soil preparation involves adding 40 kg of lime per 10-cent polyhouse and mixing it thoroughly. After two weeks, incorporate 160 kg of poultry manure or 600 kg of FYM (Farm Yard Manure), followed by immediate irrigation, and then form ridges. Seeds can be directly sown or seedlings grown in trays can be transplanted. Raising seedlings in trays filled with coir pith media helps in obtaining high-quality seedlings free from pests and diseases. Before sowing, seeds should be soaked in a solution of 5 ml/liter of imidacloprid or thiamethoxam for three hours. Germination typically occurs within three days, and transplanting can be done after one week. Plant seedlings on ridges spaced 1 m apart, with individual seedlings spaced 50 cm apart within each ridge.

Manuring

Salad cucumbers thrive with ample manure. For organic cultivation, a mixture of organic manures such as FYM, bonemeal, vermicompost, groundnut cake, neem cake, and wood ash in equal parts should be applied weekly. For commercial production, chemical fertilizers can be used. A basal dose of 8.70 kg urea, 5 kg factamfos, and 1.60 kg potash per 10-cent polyhouse area can be applied. Additional urea (4.7 kg) can be applied when the vines start twining. During flowering and fruiting stages, 2 kg each of urea and potash should be added. Spraying 19:19:19 @ 5 g/liter of water can be done 3-4 times at one-week intervals during fruit development. Fish amino @ 4 ml/liter is also effective for both plant growth and pest control.

Irrigation

Initially, irrigate once in every two days, and as fruiting begins, irrigate every 1-2 days at a rate of 2-5 litres per hour per plant.

Pests and Disease Control

Downy mildew and powdery mildew can occur in both summer and winter. Managing infestations involves using high-quality seeds and treating them with *Pseudomonas fluorescens* @ 20 g/kg of seed. Remove and destroy diseased plant parts, avoid foliar irrigation, ensure proper drainage and air circulation, and use biocontrol agents such as *Pseudomonas fluorescens*

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@ 20 g/liter for foliar diseases. Severe infections may require applications of Nativo (Tebuconazole + trifloxystrobin) @ 0.5 ml/liter. Integrated pest management can control pests like leaf-feeding caterpillars, leaf thrips, Epilachna beetles, and fruit flies. Neem oil garlic emulsion (20 ml/liter) and *Verticillium lecanii* (10 g/liter) can be used against leaf feeders. Fruit flies can be managed with traps. Chemical pesticides like Fame (Flubendamide) and Actara (Thiomethoxam) can be used if infestations are severe, with caution to remove harvestable fruits and wait one week post-spray before harvesting.

Other Cultural Practices

To prevent small and deformed fruits, apply a micronutrient mixture @ 10g/liter at flowering. During extreme heat, use foggers inside polyhouses between 12 PM and 2 PM for 60 seconds at one-hour intervals.

Harvesting

Harvest tender fruits 7-8 days after flowering. Average yield is 4 kg per plant. Fruits can be stored for one week at room temperature.

Conclusion

Being a vegetable crop with high demand, protected cultivation of salad cucumber is gaining more importance. Popularizing KPCH-1 will help the farmers all over India for more extensive and successful cultivation of cucumber under polyhouses giving high profit because of availability of hybrid seeds at very low cost and better yield.