# Effectiveness of botanicals, inorganic salts and fungicide against Fusarium wilt of muskmelon under hot arid region of Rajasthan

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## Summary

Investigation was undertaken to screen out the extract of botanicals viz., Neem leaf, Tumba fruit, NSKE and Aak leaf and inorganic salts against Fusarium wilt of muskmelon. This disease caused by Fusarium acuminatum is a major fungal disease causing serious losses to muskmelon growing areas in Rajasthan. The field trials were carried out on muskmelon susceptible variety 'RM-50' against Fusarium wilt during summer season of 2019 and 2020 at this Institute. Among 11 treatments, carbendazim (0.1%) was found the most effective treatment for management of Fusarium wilt with minimum disease incidence (PDI) of 15.83% and 60.84% disease reduction, followed by neem leaf extract @ 10% with disease incidence of 21.89% and 45.84% disease reduction. Maximum disease incidence (40.42% PDI) was found in case of control.

**JAE 2022, Vol 14**
**Received:** 15 July 2022
**Accepted:** 05 Sept. 2022
**Published:** 20 Sept. 2022
**https://doi.org/10.53911/JAE.2022.14203**

**Associate Editor:** Dr. PN Sivaligam



**Keywords:** Botanicals; efficacy; Fusarium wilt; inorganic salts; muskmelon

## INTRODUCTION

Muskmelon (*Cucumis melo* L.) is one of the important cucurbitaceous crops. It is commonly known as '*Kharbooja*'. Its fruits are the best source for overcoming nutrient deficiencies and provide per unit area high income to the small and marginal farmers. The fruits are used as dessert which contains 0.6% protein, 0.2% fat, 3.5% carbohydrates, 32 mg calcium, 14 mg phosphorus, 1.4 mg iron, 16 mg carotene and 26 mg vitamin C per 100 g fresh weight of fruit.[3] It is well known for eating as dessert fruits, which is easily digestible with high yield potential. A number of angiospermic plants have been reported to possess antimicrobial activity, which is a potential alternate for chemical control.[20, 6, 5] This crop has the ability to tolerate moderate to high temperature which ensures its adaptability for wide spread cultivation throughout the tropics. However, the climatic conditions of western Rajasthan are altogether different from other parts of India which is characterized by very high potential evapo-transpiration rate, intense solar radiations, high wind velocity (20 km/hr), high infiltration (9 cm/ hr), extremes of temperature (0 to 48°C), low relative humidity, low soil fertility, high soil pH, saline ground water, etc.[14] Under such harsh climatic conditions, cultivation of existing muskmelon varieties results in very low and poor quality yield which fetches less return per unit area.

Plant extracts that possess secondary compounds as well as water soluble alkaloids and other bioactive compounds have been investigated with regard to their potential for controlling phyto-pathogens.[19, 1, 8] Its cultivation is adversely affected by several major diseases such as Fusarium wilt, fruit rot, downy mildew and stem decline under hot arid region. Among them, Fusarium wilt caused by *Fusarium acuminatum* Ellis and Everh is an important fungal disease causing serious losses to muskmelon.[7] In the world, wilt is considered as one of the most economically important diseases of muskmelon.[4] Wilt symptoms coincide with flowering stage of the crop and leaves are accompanied by yellowing and marginal necrosis. Infected areas appear brown and water soaked. As a result of softening of the tissue, the plants shriveled, followed by died of whole plant.[7] Use of fungicides leads to severe environmental pollutions and reduction of beneficial microbes.[12] Non-chemical and eco-friendly botanicals and bio-control agents as broad spectrum fungicides have been found to

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provide an answer to the non-discriminatory broad spectrum fungicides. So far, information available on this aspect in muskmelon under western Rajasthan is scanty. Keeping in view, the present study was undertaken to test effectiveness of botanicals, inorganic salts and fungicide against Fusarium wilt of muskmelon under field conditions of Rajasthan.

## Materials and Methods

The field trials were conducted during summer season of 2019 and 2020 at Pathology Block of ICAR-Central Institute for Arid Horticulture, Bikaner (Rajasthan) located at $28^0$N latitude, $73^0 18^1$E longitude at an altitude of 234.84 m above sea level in randomized block design with three replications. Muskmelon variety 'RM-50' was sown in the last week of February during both the years (2019 and 2020) and tested effectiveness of botanicals, inorganic salts and fungicide against Fusarium wilt. The spacing maintained between rows was 2.0 m and between plants 0.50 m. Eleven treatments such as *neem* leaf extract @ 5%, *neem* leaf extract @ 10%, *tumba* fruit extract @ 5%, *tumba* fruit extract @ 10%, *aak* leaf extract @ 5%, *aak* leaf extract @ 10%, *neem* seed kernel extract (NSKE) @ 5%, salicylic acid @ 500 ppm and borex @ 500 ppm, carbendazim (0.1%) and control (treatment of untreated check without spray) were taken in the field trials during both the years for management of *Fusarium* wilt of muskmelon.

Neem (*Azadirachta indica*), Tumba (*Citrullus colocynthis*) and Aak (*Calotropis gigantean*) plants were used as extracts. The plant parts used were leaf (*Neem* and *Aak*), seed kernel (*Neem*) and fruits (*Tumba*). Empirically, plant extracts have been used in non-conventional agriculture production systems for the control of plant diseases. Such extracts are often produced in a homemade fashion from materials available that are sprayed or drenched on the crops.[18] In order to obtain the aqueous extracts, the plant material was collected locally, thoroughly washed using tap water to remove the dusts and crushed in sterile distilled water @ of 1 g tissue/ml of water (1:1 w/v) using sterilized pestle and mortar. The aqueous extract was partially purified by passing through a double layer of muslin cloth. The filtrate was used plant extract of 100% concentration. Neem seed kernels and Tumba fruits were finely ground separately and soaked in water over night. The mixture was filtered. Further dilutions were made of the extracts with sterile distilled water to get desired concentrations.[11] The activity of aqueous plant extracts at 5% and 10% concentrations of each botanicals were sprayed on the crops against mosaic disease.

Weekly observations were recorded on disease incidence and per cent disease index (PDI) as well as per cent disease reduction (PDC) were calculated by standard formula. Three drenchings of each treatment were done in the crop. First drenching was applied at the appearance of the first disease symptoms. The second and third drenching of same concentration were done at 10 days interval. Observations were recorded regularly on disease incidence of mosaic symptoms in ridge gourd. Total number of plants and number of infected plants by this disease in each replication of the crop were counted and disease incidence was calculated by following formula:

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Percent disease index (PDI) was also calculated. Two year data (2019 and 2020) on PDI were pooled as well as angular transformed and statistically analyzed by off campus CCSHAU, Hisar (Haryana) OPSTAT statistical analysis software in RBD. Percent disease index (PDI) and percent disease control (PDC) were also calculated by following formula:

$$\text{PDI} = \frac{\text{Sum of all disease ratings}}{\text{Total no. of leaves observed} \times \text{maximum disease grade}} \times 100$$

$$\text{Percent Disease Control (PDC)} = \frac{\text{\% disease incidence in control} - \text{\% disease incidence in treatment}}{\text{\% disease incidence in control}} \times 100$$

## Results and Discussion

Results of pooled data (2019 and 2020) clearly indicated that all the treatments were found superior over control for reducing the Fusarium wilt disease in muskmelon (Table 1). However, among 11 treatments, carbendazim (0.1%) was found the most effective treatment against Fusarium wilt with minimum disease

incidence of 15.83% (PDI) which reduced 60.84% disease control, followed by neem leaf extract @ 10% with PDI of 21.89% and it reduced 45.84% disease control. Both the treatments were statistically differing to each other in respect of disease incidence. The next best treatments were *tumba* fruit extract @ 10% with disease incidence of 24.40% having 39.63% disease reduction and *aak* leaf extract @ 10% with disease incidence of 27.98% which reduced 30.77% disease control and both were also statistically differ with each other in case of disease incidence. Neem leaf extract (5%) and NSKE (5%) were statistically at par with each other in respect of disease incidence. Least effective inorganic salts were borex @ 500 ppm and salicylic acid @ 500 ppm having 36.93% and 37.19% disease incidence as well as 8.63% and 7.99 per cent disease reduction, respectively. Maximum disease incidence of 40.42% was found in case of control of pooled data (Table 1).

**Table 1: Management of *Fusarium* wilt disease in muskmelon under field conditions during summer season of 2019 & 2020 (pooled data)**

| S. No. | Treatments | Doses | Disease incidence (PDI) of the year 2019 | Disease incidence (PDI) of the year 2020 | Disease incidence (PDI) of pooled data | Per cent disease reduction (%) |
|---|---|---|---|---|---|---|
| 1. | Neem leaf extract | 5% | 28.73 *(32.75) | 31.54 *(34.08) | 30.13 *(33.41) | 25.46 |
| 2. | Neem leaf extract | 10% | 19.67 (26.31) | 24.12 (29.34) | 21.89 (27.82) | 45.84 |
| 3. | Tumba fruit extract | 5% | 31.18 (33.92) | 34.48 (35.91) | 32.83 (34.91) | 18.77 |
| 4. | Tumba fruit extract | 10% | 22.35 (28.18) | 26.45 (30.87) | 24.40 (29.52) | 39.63 |
| 5. | NSKE | 5% | 30.26 (33.34) | 32.72 (34.86) | 31.49 (34.10) | 28.36 |
| 6. | Aak leaf extract | 5% | 32.67 (34.82) | 36.17 (36.94) | 34.42 (35.88) | 14.84 |
| 7. | Aak leaf extract | 10% | 26.84 (31.17) | 29.13 (32.54) | 27.98 (31.85) | 30.77 |
| 8. | Borex | 500 ppm | 35.12 (36.32) | 38.74 (38.46) | 36.93 (37.39) | 8.63 |
| 9. | Salicylic acid | 500 ppm | 34.53 (35.95) | 39.86 (39.12) | 37.19 (37.53) | 7.99 |
| 10. | Carbendazim | 0.1% | 14.29 (22.12) | 17.38 (24.51) | 15.83 (23.31) | 60.84 |
| 11. | Control | - | 39.58 (38.96) | 41.26 (39.94) | 40.42 (39.45) | - |
| CD (P=0.05) | | | 3.13 | 5.19 | 2.82 | |

* Figures in parenthesis are angular transformed values.

Ansari et al. (2007)[2] used botanicals and plant products and found that spraying with Neem seed kernel extracts and leaf extract of *Thuja* and *Cupressus* proved effective in reducing disease incidence of tomato leaf curl. Hassanein et al. (2010)[10] conducted an experiment on the effect of neem leaf extract against *Fusarium oxysporum*, the causal agents of tomato wilt. There was significant gradual increase in growth parameters when the plants were sprayed and irrigated with aqueous neem extract. In this study, neem leaf extract also showed satisfactory result against *Fusarium oxysporum*. Shafique et al. (2015)[17] reported that the wide variety of organic matters that have been tested as organic amendments for managing plant pathogens, oil seed cakes decreased the population of soil-borne pathogens (*Fusarium* spp.). Haldhar et al. (2014)[9] reported that the organic IPM system proved to be the most effective and economical approach (B: C ratio 8.80:1) in muskmelon pest, which the lowest incidence was recorded as compared to other modules. The organic IPM module-III comprised of growing resistant genotype (RM-50), spray of neem oil at 20 DAS, installation of pheromone trap (10/ hectare) at

42 DAS, spray of tumba fruit extract (TFE 5%) at 50 DAS and spray of spinosad 46 SC at 60 DAS was the most effective. The benefit-cost ratio of the tested muskmelon production systems in the control of insect-pests decreased in the following order: module-III (B: C ratio 8.80:1)> module-I (B: C ratio 7.74:1)> module-IV (B: C ratio 6.60:1)> module-II (B: C ratio 3.56:1).

Nagendran et al. (2017)[15] found that application of botanical pesticides such as @ 5% NSKE or 3% neem oil was effective against mosaic disease on cucurbits. They also found that spray of neem bio-pesticide (3-5 ml/l) at 45 DAS was also found effective against yellow vein mosaic disease on okra. According to Khatun et al. (2020),[13] garlic extract gave the highest yield (29.66 t/ha) which was statistically identical to positive control (30.55 t/ha). Other treatments also showed better performance in increasing yield and suppressing Fusarium wilt of tomato.

## Conclusion

From the above study, it may be concluded that carbendazim (0.1%) and neem leaf extract (10%) may be used in management approach in controlling Fusarium wilt of muskmelon under field condition.

### Declaration of interests

The authors have no conflict of interest to declare.

### Data sharing

All relevant data are within the manuscript.

### Acknowledgments

All sort of assistance rendered by ICAR – Central Institute for Arid Horticulture, Bikaner – 334006, India for the above study is gratefully acknowledged.

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**Preferred citation:** Maheshwari SK, Choudhary BR, Haldhar SM & Berwal MK. 2022. Effectiveness of botanicals, inorganic salts and fungicide against Fusarium wilt of muskmelon under hot arid region of Rajasthan. *Journal of Agriculture and Ecology*, 14: 21-25; http://doi.org/10.53911/JAE.2022.14203