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Studies on bioefficacy, phytotoxicity and residue of metalaxyl 4% + mancozeb 64% against foliar diseases cauliflower

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Abstract

Foliar diseases of cauliflower have become a major constraint in cauliflower growing areas causing qualitative as well as quantitative losses. Therefore, a field experiment was carried out for two years at College of Horticulture, Hiriya for bio efficacy and phytotoxicity of metalaxyl 4% + mancozeb 64% against foliar diseases of *Alternaria* leaf blight, *Cercospora* leaf spot and Downy mildew of cauliflower. Results revealed that all the treatments significantly reduced the leaf spot incidence and intensity, over untreated control. Amongst all the treatments significantly least average disease incidence was recorded with the treatment, with foliar sprays of metalaxyl 4% + mancozeb 64% @ 3g/lit recorded least Percent Disease Index (PDI) (5.00, 7.67 and 8.25 respectively) and highest curd yield of 12.92 followed by metalaxyl 4% + mancozeb 64% @ 2.5g/lit.

Keywords: Cauliflower, phytotoxicity, Bioefficacy, leaf spot, downy mildew

Introduction

Cauliflower (*Brassica oleracea* var. *botrytis*) belongs to genus *Brassica* and family *Brassicaceae*. It is now grown in many countries like China, India, Spain, Italy, France, U.S.A. Pakistan and U.K. In India cauliflower cultivated on area 4,59,000 ha, with production (8805 mt) (Anonymous, 2016-17). Cauliflower (*Brassica oleracea*) is a cool-season crop in the crucifer family. While it is closely related to broccoli and cabbage, cauliflower is more exacting in its environmental requirements than other cole crops. Cauliflower is very sensitive to unusually hot weather and drought. The crop is affected by many fungal, bacterial and viral plant pathogens among them fungal diseases of *Alternaria* leaf blight (*Alternaria brassicae* (Berk.) Sacc), *Cercospora* leaf spots (*Cercospora brassicicola*) and Downy mildew (*Peronospora parasitica*) of cauliflower has become a major constraint in cauliflower growing areas. At least 20 percent of agricultural spoilage is caused by this pathogen. Most severe losses may reach up to 80 percent of yield. Leaf spot, downy mildew of cauliflower are difficult to control because there are several sources of inoculum including infected seed, plant debris in the soil and nearby infected cruciferous crops and the disease spread rapidly during warm and wet conditions affecting a significant proportion of the cauliflower crop. Therefore, keeping in view the economic losses caused by these diseases, the present study was aimed at determining an effective management for foliar diseases.

Material and methods

A field experiment on bio efficacy and phytotoxicity of Metalaxyl 4% + Mancozeb 64% against foliar diseases of cauliflower were conducted at College of Horticulture, Hiriya during 2012-13 and 2013-14. The experiments consisted of 7 treatments viz., untreated check, metalaxyl 4% + mancozeb 64% (2.0, 2.5 and 3.0 g/ litre), metalaxyl 8% + mancozeb 64% (Ridomil Gold 72%WP) (2.5 g/ litre), mancozeb (2.5g) and copper oxychloride (standard check 3.0g) and was laid-out in Randomized Block Design with four replication. A susceptible variety was used in the present investigations. The variety was grown as per packages of practices for higher yields. Treatments were imposed at beginning of the disease appearance. Spray schedule was repeated at 15 days intervals. The Percent disease index (PDI) was computed by selecting five plants at random and recording severity as per 0-5 scale (Verma and Saharan, 1994) where 0, no disease; 1, 1-10%; 2, 11-25%; 3, 26-50%; 4, 51-75%; 5, 76-100% after each spray. Average of all spray has been given in this and the data was statistically analyzed after suitable transformations.

For phytotoxicity studies

| Sl. No. | Treatments | g.a.i./lit of water | Formulation |
|---------|---|---------------------|-------------|
| 1 | Untreated check | | |
| 2 | Metalaxyl 4% + Mancozeb 64%(Ridomil Gold 68%WP) | 2.04 | 3.0 |
| 3 | Metalaxyl 4% + Mancozeb 64%(Ridomil Gold 68%WP) | 4.08 | 6.0 |

The percent disease index (PDI) was calculated by the formula:

$$\text{Per cent disease index (PDI)} = \frac{\text{Sum of the individual disease ratings}}{\text{Number of leaves observed} \times \text{Maximum disease grade}} \times 100$$

Results and discussion

Results (Table 1) revealed that the two years pooled data of percent disease index of foliar diseases and curd yield of cauliflower differed significantly among the treatments.

Percent disease index

During the first year spray, there are much significant differences among the treatments imposed with respect to the reduction of foliar diseases. However, the plots sprayed with metalaxyl 4% + mancozeb 64% @ 3.0 g/lit has recorded lowest PDI of downy mildew (4.83), *Alternaria* leaf spot (7.33) and *Cercospora* leaf spot (7.83) which was on par with treatment metalaxyl 8% + mancozeb 64% @ 2.5 g/lit (10.33, 7.50 and 10.33 PDI, respectively) expect control table.1. During second year spray, there were no much significant differences among the treatments imposed with respect to the reduction of foliar disease compare to the first season. The disease severity of *Alternaria* leaf spot (8.00), downy mildew (5.17) and *Cercospora* leaf spot (8.67) has been observed after spray with Metalaxyl 4% + mancozeb 64% @ 3.0 g/l however this treatment is on par with other treatment metalaxyl 4% + mancozeb 64% @ 2.5 g/l (11.33, 7.42 and 13.50 PDI, respectively) which is followed by mancozeb 2.5 g/l.

Curd yield

The comparative curd yield were also recorded and the same treatment of metalaxyl 4% + mancozeb 64% @ 3.0 g/l has recorded the highest curd yield of 13.17t/ha followed by metalaxyl 4% + mancozeb 64% @ 3.0 g/l (10.50t/ha).

During the second year the comparative curd yield was also recorded highest in the same treatment of metalaxyl 4% + mancozeb 64% @ 3.0 g/l. It has recorded the highest curd yield of 12.67 t/ha followed by chlorothalonil 75% WP @ 1.5g/lit (9.0t/ha). As per the results the chlorothalonil 75% WP @ 1.5g/lit @ 2.0 g/l has recorded 70.16 percent higher curd yield in compare to the standard chemical Mancozeb @ 2.0g/l.

Discussion

The efficacy of different concentration metalaxyl 4% + mancozeb 64% was evaluated against the foliar diseases of cauliflower under the field conditions. Experimental results revealed that all the fungicides tested reduced the disease intensity significantly compared to control. Amongst all the treatments metalaxyl 4% + mancozeb 64% at 3.0 and 2.5 g/lit proved most efficacious in limiting the foliar disease in two seasons and provided the highest curd yield. These findings corroborate those of other workers such as Kaushik *et al.* (1983) [4]; Shivpuri *et al.* (1988) [7]; Khan *et al.* (1991) [5]; Vishwanath and Kolte (1997) [9]; and Godika *et al.* (2001) [3]. Ram Devi Timila reported that spraying of Klnaxyl (0.2%) concentration can effectively manage the downy mildew disease.

Phytotoxicity

There were no phytotoxicity symptoms like Epinasty, hyponasty, vein clearing, yellowing, necrosis, leaf margin burning, roseting and wilting were observed in different concentrations of metalaxyl 4% + mancozeb 64%(Ridomil Gold 68%WP).

Table 1: Bioefficacy Metalaxyl 4% + mancozeb 64% against foliar diseases of cauliflower during 2013-14 and 2014-15 (Average of all 3 spray)

| Sl. No | Treatments | Conc | Disease severity (PDI) | | | | | | | | |
|--------|---|------|------------------------|-----------------|-----------------|-----------------------------|-----------------|-----------------|-----------------------------|-----------------|------------------|
| | | | Downy mildew | | | <i>Alternaria</i> leaf spot | | | <i>Cercospora</i> leaf spot | | |
| | | | 2012-13 | 2013-14 | Pooled | 2012-13 | 2013-14 | Pooled | 2012-13 | 2013-14 | Pooled |
| 1 | Untreated check | - | 22.83* (4.83)# | 24.83 (5.03) | 23.83 (4.93) | 30.17 (5.54) | 25.83 (5.13) | 28.00 (5.35) | 28.33 (5.36) | 28.67 (5.40) | 28.5 (5.38) |
| 2 | Metalaxyl 4% + Mancozeb 64% (Ridomil Gold 68%WP) | 2.0g | 10.17 (3.26) | 7.83 (2.86) | 9.00 (3.06) | 12.00 (3.54) | 13.17 (3.69) | 12.56 (3.62) | 8.83 (2.87) | 14.33 (3.85) | 11.58 (3.36) |
| 3 | Metalaxyl 4% + Mancozeb 64% (Ridomil Gold 68%WP) | 2.5g | 5.50 (2.45) | 6.58 (2.66) | 6.04 (2.55) | 9.00 (3.08) | 9.83 (3.21) | 9.42 (3.12) | 9.83 (3.21) | 11.50 (3.46) | 10.665 (3.34) |
| 4 | Metalaxyl 4% + Mancozeb 64% (Ridomil Gold 68%WP) | 3.0g | 4.83 (2.31) | 5.17 (2.38) | 5.00 (2.34) | 7.33 (2.79) | 8.00 (2.91) | 7.66 (2.85) | 7.83 (2.88) | 8.67 (3.02) | 8.25 (2.95) |
| 5 | Metalaxyl 8% + Mancozeb 64% (Ridomil Gold 72%WP) | 2.5g | 7.50 (2.82) | 7.42 (2.81) | 7.46 (2.81) | 10.33 (3.29) | 11.33 (3.44) | 10.83 (3.37) | 10.33 (3.29) | 13.50 (3.74) | 11.915 (3.52) |
| 6 | Mancozeb 75 WP | 2.5g | 14.00 (3.80) | 13.00 (3.67) | 13.50 (3.73) | 16.17 (4.08) | 16.67 (4.14) | 16.42 (4.11) | 17.17 (4.20) | 18.50 (4.36) | 17.835 (4.28) |
| 7 | standard check (copper oxychloride) | 3.0g | 15.17 (3.95) | 11.50 (3.46) | 14.23 (3.70) | 17.50 (4.24) | 15.33 (3.98) | 16.42 (4.11) | 16.67 (4.14) | 17.33 (4.22) | 17 (4.28) |
| | S.Em± | | 0.91 | 0.80 | 0.85 | 0.65 | 0.67 | 0.70 | 1.49 | 0.57 | 1.03 |
| | CD @ 5% | | 2.75 | 2.44 | 2.59 | 1.98 | 2.04 | 2.12 | 4.52 | 1.74 | 3.13 |

Table 2: Impact of Metalaxyl 4% + Mancozeb 64% against foliar diseases of cauliflower during 2012-13 (Average of all 3 spray)

| Treatments | Dose (g or ml/lit) | Score value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--------------------|-------------|---|---|---|---|---|-------|---|---|---|---|---|------|---|---|---|---|---|------|---|---|---|---|---|-------|---|---|---|---|---|
| | | 1DAA | | | | | | 3 DAA | | | | | | 5DAA | | | | | | 7DAA | | | | | | 10DAA | | | | | |
| | | A | B | C | D | E | F | A | B | C | D | E | F | A | B | C | D | E | F | A | B | C | D | E | F | A | B | C | D | E | F |
| Untreated check | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Metalaxyl 4% + Mancozeb 64%(Ridomil Gold 68%WP) | 2.5 g | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Metalaxyl 4% + Mancozeb 64%(Ridomil Gold 68%WP) | 3.0 g | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

A: leaf injury on tips and leaf surface; B: Wilting; C: leaf vein clearing; D: Necrosis; E: Epinasty; F: Hyponasty; DAA: Days after Application

Conclusion

Based on the two years experimentation it has been found that, metalaxyl 4% + mancozeb 64% @ 3.0g/l is most effective in management of foliar diseases (downy mildew) of cauliflower which is followed by the same fungicides @ 2.5 g/l when compared to the other treatments. metalaxyl 4% + mancozeb 64% @ 3.0g/l was found to be optimum dosage for management of foliar diseases and harvest of maximum yield. metalaxyl 4% + mancozeb 64% @ 3.0 g/l was found to be no phytotoxic and safe to cauliflower crop.

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