International Journal of Bio-resource and Stress Management 2014, 5(4):549-552 DOI:10.5958/0976-4038.2014.00612.5

Short Research Article

Spray Scheduling for Management of Foliar Diseases in Onion (*Allium cepa* L.)

P. Tripathy*, B. B. Sahoo, A. Priyadarshini, D. Patel and D. K. Dash

All India Network Research Project on Onion and Garlic, College of Horticulture, O.U.A.T., Sambalpur, Odisha (758 025), India

Article History

Manuscript No. AR764
Received in 13th May, 2014
Received in revised form 10th November, 2014
Accepted in final form 5th December, 2014

Correspondence to

E-mail: ptripathy_ouat05@rediffmail.com

Keywords

Onion, foliar disease, thrips, insecticide

Abstract

Among the various foliar diseases affecting leaves and bulbs of onion, purple blotch incited by *Alterrinari porri* Ell (Ciferri), while thrips (*Thrips tabaci* Lindeman) among the insects are the most devastating and prevalent in India. The present investigation was conducted to study the spray scheduling for management of foliar diseases in onion during *rabi* season of 2010-11 to 2012-13 under AINRPOG, College of Horticulture(OUAT), Odisha, India in RBD with six treatments replicated four times. The spray schedule consists of combined spray of both broad spectrum and contact fungicides with or without insecticides in alternate fashion along with control. The results revealed significantly minimum disease incidence (74.26 ,68.17 and 65.01%), severity (54.25, 31.25 and 33.00%), thrips plant^{-1} (33.50, 17.79 and 19.68) , marketable bulb yield (19.58,13.75 and 15.66 t ha^{-1}) and total bulb yield (27.95, 24.88 and 27.60 tha^{-1}) were recorded with spray schedule of mancozeb @ 0.25%+methomyl @ 0.8 g l^{-1}, tricyclazole @ 0.1%+carbosulfan @ 2 ml l^{-1} and Hexaconazole @0.1%+profenofos 1 ml l^{-1} at 30, 45 and 60 DAT (T_4) during three consecutive years, respectively. The next best recommendation was application of mancozeb @ 0.25%+methomyl @ 0.8 g l^{-1}, propiconazole @ 0.1%+carbosulfan @ 2 ml l^{-1} and copper oxychloride @ 0.25%+profenofos 1ml l^{-1} at 30, 45 and 60 DAT (T_3) in onion. Thus, it may be concluded that, combined application of insecticides and fungicides not only reduces the incidence of foliar disease and thrips infestation but also increases bulb yield instead of their sole application during 30 to 60 DAT.

1. Introduction

Onion (*Allium cepa* L.) is an important export oriented vegetable among the cultivated *Allium* in India. The genus *Allium* includes around 750 species out of which over 20 other *Allium* species have been consumed by humans excluding the most important edible *Alliums* i.e. onion, Japanese onion, leak and garlic (van der Meer, 1997). Onion, the principal *Allium*, ranks second in value after tomatoes on the list of cultivated vegetable crops worldwide (FAO, 2001). India ranks 1st in position both in area (1.2 mha) and production (19.3 mt) in the world (FAO STAT, 2013). Although India enjoys the better position for both area and production in the world, the productivity of onion is affected by several biotic and abiotic stresses. For commercial cultivation of Onion, both thrips and foliar diseases play the key role in reducing the bulb yield and quality of produce. Among the various foliar diseases affecting leaves and bulbs, purple blotch incited by *Alternaria porri* Ell (Ciferri), while thrips (*Thrips tabaci* Lindeman) among the insects are the most devastating and prevalent in many parts of India, including in Odisha (Tripathy et al., 2012). This is more important due to change in climatic conditions during the growing season. The Onion thrips (*Thrips tabaci* Linderman) can indirectly aggravate purple blotch and vector for viral diseases, iris yellow spot as well (Krishna Kumar et al., 2011). Hence, there is an immense need to develop proper integrated management practice to contain onion pests (onion thrips) and diseases, particularly purple blotch in order to produce higher yield with better quality bulbs. The present study was therefore, conducted to study the spray scheduling for management of foliar diseases in onion.

2. Materials and Methods

The experiment was carried out under All India Network Research Project on Onion and Garlic, College of Horticulture (OUAT), Sambalpur, Odisha, India during the *rabi* season of 2010-11 to 2012-13 in RBD with six treatments replicated four times. The details of treatments are presented in Table 1.

Onion seedlings variety Agrifound Dark Red of about 45 days old were transplanted in plot size of 3×2 m^2 for each replication with a spacing of 15×10 cm^2 on 23.12.2010, 01.12.2011 and 08.09.2012, respectively. All the recommended package of practices was adapted uniformly to all the modules except the plant protection measures which were adopted on the basis of treatment schedules. The crop was observed for both onion thrips as well as Purple Blotch disease at 15 days intervals commencing from 30 days after transplanting. The data on disease incidence were recorded and the % of disease intensity was calculated by adopting 0-5 point scale such as 0=no disease, 01=1-10%, 02=11-20%, 03=21-30%, 04=31-50% and 05=51-100%. The data on thrips infestation were transformed and subjected to statistical analysis. The total bulb yield for each cultivar was recorded and statistically analyzed as per the standard procedure (Sukhatme and Amble, 1995).

3. Results and Discussion

The results presented in Table 3 to 4, revealed significant variations among the spray schedule for disease incidence, disease severity, thrips plant^{-1} as well as bulb yield (marketable and total) in onion variety, Agrifound Dark Red during all the three years of study (2010-11 to 2012-13).

3.1. Foliar disease incidence and severity

The disease incidence during 2010-11, varies from 74.26% (T_4) to 91.60% (T_5) with an average incidence of 81.67% (Table 2). Significantly minimum disease incidence was recorded with spray schedule of T_4, i.e; mancozeb @ 0.25%+methomyl @ 0.8 g l^{-1}, tricyclazole @ 0.1%+carbosulfan @ 2 ml l^{-1} and Methomyl @0.1%+profenofos 1 ml l^{-1} at 30, 45 and 60 DAT than rest of the treatments except T_3,i.e; mancozeb @ 0.25%+methomyl @ 0.8 g l^{-1}, propiconazole @ 0.1%+carbosulfan @ 2 ml l^{-1} and copper oxychloride @ 0.25%+profenofos 1 ml l^{-1} at 30, 45 and 60 DAT which were at par statistically. While during 2011-12, the disease incidence was varies from 68.17% to 85.11%, with an average incidence of 75.20%, significantly minimum incidence being recorded in T_4. Similar trend was also recorded during 2012-13. From the present investigation over three years, it may be concluded that both spray schedule of T_4 and T_3 were significantly very effective than rest of the treatments to reduce the incidence of purple blotch disease in onion. The better efficacy of mancozeb @ 0.25%+methomyl @ 0.8 g l^{-1}, tricyclazole / propiconazol @ 0.01%+carbosulfan @ 2 ml l^{-1} and copper oxychloride @ 0.25% / hexaconazole @ 0.1%+profenofos 1 ml l^{-1} at 30, 45 and 60 DAT against purple blotch under Odisha condition was also well documented by Tripathy et al. (2014). Similar report on efficacy of tricyclazole, propiconazole and hexaconazole in controlling *Alternaria porri* was reported by Kanzaria et al.(2011) under Junagarh condition.

Regarding disease severity, expressed as PDI (%) varies significantly among different spray schedules over three years of experimentations. The disease severity varies from 54.25%, 31.25% and 33.00% in T_4 to 70.73%, 50.00% and 44.00% in T_5 during 2010-11, 2011-12 and 2012-13, respectively. Significantly lowest disease severity was recorded with treatment T_4 than rest of the spray schedule except, T_2, T_3 and T_6 during 2010-11 and 2011-12 while only T_3 during 2012-13, where statistical parity were observed (Table 3). The results over three years indicated the superiority of T_4, T_2, T_3 and T_6 over other treatments with respect to disease severity in onion. The results also showed that sole application of insecticides significantly reduces the disease severity in onion, indicating the vital role play by onion thrips in controlling foliar diseases in onion. This result corroborates the findings of Krishna Kumar et al. (2011) in onion. According to them, onion thrips (*Thrips tabaci* Linderman) not only directly damage both foliage and bulbs, but also indirectly aggravate purple blotch and vector for Iris Yellow Spot Tospovirus (IYSV) in onion. The better efficacy of propiconazole @ 0.1% and mancozeb @ 0.25% against foliar diseases in onion was also reported by Gupta and Pandey (2011).

3.2. Thrips infestations

Significant variations were also recorded among the treatment schedules for thrips infestation in all the three years under study (Table 3). The thrips population (thrips plant^{-1}) varies from 33.50 (T_4) to 45.63 (T_5) during 2010-11; 17.14 (T_6) to 25.64 (T_5) during 2011-12 as well as 19.68 (T_6) to 29.33 (T_5)

Table 1: Treatment details of management of foliar diseases

Treatments	First spray (30 DAT)	Second spray (45 DAT)	Third spray (60 DAT)
T_1	Mancozeb 0.25%	Propiconazole 0.1%	Copper oxychloride 0.25%
T_2	Mancozeb 0.25%	Tricyclazole 0.1%	Hexaconazole 0.1%
T_3	Mancozeb 0.25%+ Methomyl 0.8 g l^{-1}	Propiconazole 0.1%+carbosulfan 2 ml l^{-1}	Copper oxychloride 0.25%+ Profenofos 1 ml l^{-1}
T_4	Mancozeb 0.25% Methomyl 0.8 L^{-1}	Tricyclazole 0.1%+carbosulfan 2 ml l^{-1}	Hexaconazole 0.1%+profenofos 1 ml l^{-1}
T_5	Untreated check	--	--
T_6	Methomyl 0.8g L^{-1}	Carbosulfan 2 ml l^{-1}	Profenofos 1 ml l^{-1}

Table 2: Disease Incidence and severity (%) of purple blotch as influenced by different spray schedule

Treatments	Disease incidence (%)				Disease severity (PDI, %)			
	2010-11	2011-12	2012-13	Mean	2010-11	2011-12	2012-13	Mean
T_1	82.96 (65.61)*	76.71 (61.16)	73.72 (59.14)	77.80 (61.87)	61.65 (51.76)	41.25 (49.00	37.40 (37.69)	46.77 (43.14)
T_2	83.84 (66.29)	76.11 (60.84)	74.59 (59.72)	78.18 (62.14)	57.55 (49.34)	31.25 (46.30)	36.90 (37.40)	41.90 (44.35)
T_3	77.17 (61.46)	71.59 (57.79)	67.92 (55.50)	72.22 (58.18)	55.82 (48.34)	31.25 (45.83)	32.50 (34.75)	39.86 (39.14)
T_4	74.26 (59.53)	68.17 (55.69)	65.01 (53.74)	69.15 (56.25)	54.25 (47.43)	31.25 (44.89)	33.00 (35.05)	39.50 (38.93)
T_5	91.60 (73.24)	85.11 (67.29)	82.35 (65.17)	86.35 (68.30)	70.73 (57.25)	50.00 (55.03)	44.00 (41.54)	54.91 (47.81)
T_6	80.12 (63.52)	73.51 (59.03)	74.87 (59.91)	76.17 (60.77)	58.88 (50.13)	41.25 (47.52)	39.50 (38.93)	46.54 (43.01)
Grand mean	81.67 (64.94)	75.20 (60.30)	73.07 (58.86)	76.65 (61.09)	59.81 (51.71)	41.25 (48.10)	37.22 (37.56)	46.09 (42.75)
SEm±	1.23	1.47	1.04		1.47	1.35	0.93	
CD (p=0.05)	2.61	3.14	2.22		3.13	2.87	1.97	

Figures in the parentheses indicate the corresponding angular values

during 2012-13 (Table 3). Significantly least thrips population was recorded in T_6 than other treatments. However, statistical parity was observed for with T_2, T_3 and T_4 during 2010-11 and 2011-12 only. Hence, from the investigation conducted for three years, it may be recommended for combined application of fungicides and insecticides for controlling the foliar diseases and thrips effectively in onion than their sole application.

3.3. Bulb yield

Significantly highest marketable bulb yield of 19.58 t ha^{-1}, 13.75 t ha^{-1} and 15.66 t ha^{-1} were recorded in T_4 during 2010-11, 2011-12 and 2012-13, respectively than rest of the treatment schedules (Table 4). However, statistical parity was recorded with T_3 (18.98 t ha^{-1}) during 2010-11, T_2, T_3 and T_6 (12.61 to 13.75 t ha^{-1}) during 2011-12 while T_1,T_2, T_3 and T_6 (12.26 to 15.33 t ha^{-1}) during 2012-13. Similarly, significant variations were recorded among the treatment schedules for total bulb yield, which varies from 21.31 t ha^{-1} (T_5) to 27.95 t ha^{-1} (T_4) during 2010-11, 18.35 t ha^{-1} (T_5) to 24.88 t ha^{-1} (T_4) during 2011-12 while 19.12 t ha^{-1} (T_5) to 27.60 t ha^{-1}(T_4) in 2012-13. However, statistical parity was recorded in T_2 and T_3 during 2010-11 while T_3 during both 2011-12 and 2012-13 with T_4.The results on bulb yield (both marketable and total) in onion revealed that combined application of insecticides with fungicides (T_4 and T_3) recorded significantly higher yield than rest of the spray schedules by controlling the thrips and foliar diseases efficiently.

The results of three years of experimentation indicated that

Table 3: Thrips infestation (thrips plant^{-1}) as influenced by different spray schedule

Treatment	2010-11	2011-12	2012-13	Pooled
T_1	42.00 (6.51)**	19.57 (4.48)	25.52 (5.10)	29.03 (5.43)
T_2	39.88 (6.35)	18.50 (4.36)	26.75 (5.22)	28.38 (5.34)
T_3	34.90 (5.95)	17.25 (4.21)	23.09 (4.86)	25.08 (5.06)
T_4	33.50 (5.82)	17.79 (4.27)	21.59 (4.70)	24.29 (4.98)
T_5	45.63 (6.77)	25.64 (5.11)	29.33 (5.46)	33.53 (5.83)
T_6	35.75 (6.01))	17.14 (4.19)	19.68 (4.49)	24.19 (4.97)
Grand mean	38.61 (6.23)	19.32 (4.44)	24.33 (4.97)	27.42 (5.28)
SEm±	0.30	0.13	0.08	
CD (p=0.05)	0.64	0.28	0.16	

Figures in the parentheses indicate the corresponding square root of (x+0.5) values

combined spray schedule with both broad spectrum and systemic as well as contact fungicides and insecticides in alternate manners during peak period of disease and pest infestation, preferably during 30 to 60 days after transplanting, not only significantly reduced the pests and disease loads but

Table 4: Marketable Bulb yield (t ha^{-1}) as influenced by different spray schedule

Treatment	Marketable bulb yield (t ha^{-1})			Mean	Total bulb yield (t ha^{-1})			Mean
	2010-11	2011-12	2012-13		2010-11	2011-12	2012-13	
T_1	15.96	11.90	12.26	13.37	22.87	20.85	21.22	21.65
T_2	15.89	12.70	12.91	13.83	26.43	20.61	21.09	22.71
T_3	18.98	12.92	14.38	15.43	27.28	22.92	24.17	24.78
T_4	19.58	13.75	15.66	16.33	27.95	24.88	27.60	26.81
T_5	14.13	10.25	9.25	11.21	21.31	18.35	19.12	19.59
T_6	15.30	12.61	15.33	14.41	22.86	22.08	22.76	22.57
Grand mean	16.64	12.35	13.30	14.10	24.78	21.61	22.66	23.02
SEm±	1.60	0.86	1.71		1.88	1.10	1.98	
CD (*p*=0.05)	3.41	1.83	3.64		4.00	2.34	4.22	

also increases the bulb yield in onion.

4. Conclusion

First spray of mancozeb @ 0.25%+methomyl @ 0.8 g l^{-1} at 30 days after planting (DAT), tricyclazole or propiconazole @ 0.01%+carbosulfan @ 2 ml l^{-1} at 45 DAT as well as hexaconazole @0.1% or copper oxychloride @ 0.25%+profenofos @ 1 ml l^{-1} at 60 DAT, respectively were effective not only to reduce the pest and disease loads but also increases the bulb yield in onion.

5. Acknowledgements

We gratefully acknowledge the Orissa University of Agriculture and Technology, Odisha, India for the research facilities provided and to the Director, Directorate of and Onion a Garlic Research (ICAR), Rajgurunagar, Pune, India for providing the financial and other facilities to carry out this study under AINRP on Onion and Garlic.

6. References

FAOSTAT, 2013. Food and Agriculture Organization of the United Nations. Available from http://faostat.fao.org/site/567/DesktopDefault.aspx? Page ID=567#ancor.

FAO, 2001. Agrostat database, updated annually: http://apps.fao.org /

Gupta, R.C., Pandey, N.K., 2011. Integrated disease management for production of export onion bulbs (*Allium cepa* L.). In: National Symposium on Alliums: Current Scenario and Emerging Trends, 12-14 March, 2011, Pune, 236.

Kanazaria, M.V., Dhaduk, L.K., Patel, A.G., 2011. Efficacy of different fungicides /chemicals for control for leaf blight (purple blotch, *Alternaria porri*) of onion bulb crop. In: National Symposium on Alliums: Current Scenario and Emerging Trends, 12-14 March, 2011, Pune, 240.

Krishna Kumar, N.K., Srinivas, P.S., Rebjit, K.B., Asokan, R., Ranganath, H.R., 2011. Onion thrips *Thrips tabaci* Linderman: a prospective. In: National Symposium on Allium: Current Scenario and Emerging Trends, 12-14th March, 2011, Pune, 68-76.

Sukhatame, P.V., Amble, V.N., 1995. Statistical Methods for Agricultural workers. ICAR, New Delhi, 145-156.

Tripathy, P., Patel, D., Sahoo, B.B., Priyadarsini, A., Das, S.K., Dash, D.K., 2014. Studies on management of foliar diseases in onion (*Allium cepa* L.). Journal of Crop and Weed 10(2), 457-460.

Triparthy, P., Priyadarsini, A., Sahoo, B.B., Das, S.K., Dash, D.K., 2012. Management of foliar diseases in onion In: Global conference on Horticulture for food, Nutrition and Livelihood option held at OUAT on 28-31, May' 2012, 261.

Van, D., Meer, Q.P., 1997. Old and new crops within edible alliums. Acta Horticulture 433, 17-31.