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Influence of crop protective agents on okra (*Abelmoschus esculentus* L) seed germination and seedling emergence in green house

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ABSTRACT

Okra (*Abelmoschus esculentus* L) is a very common vegetable in India. Pests like Shoot and fruit borer, leaf hopper, okra stemflymites and white fly and diseases likeyellow vein mosaic, powdery mildew and wilt are endemic in okra cultivating fields of East Godavari. To curtail these problems judicious use of crop protective agents (CPAs) are a must. Indiscriminate use of crop protective chemicals on okra crop are very dangerous for the plants and humans. To know the effect of crop protective agents on seedling emergence and early seedling growth at zero concentration to double the recommended concentration, the following trial was conducted in a green house. For this experiment shortlisted crop protective agents are Ethion (@ 1.25, 2.5, 3.75 and 5.0 ml/L), Acetamiprid (@ 0.125, 0.25, 0.375 and 0.5g/L), Flubendiamide (@ 0.15, 0.3, 0.45 and 0.6 ml/L), Emamectin Benzoate (@ 0.2, 0.4, 0.6 and 0.8 g/L) and Tebuconazole & Trifloxistrobin (@ 0.625, 1.25, 1.875 and 2.5 g/L) against control (distilled water). From the experiment it is found that seed germination was significantly (P= 0.05) inhibited by all crop protective agents at all concentrations tried. Lowest seed germination was recorded in Tebuconazole + Trifloxystrobin (4.5 to 22.75%) followed by Ethion (17.5 to 48.75%), Acetamiprid (52.5 to 65.25%), Emamectin benzoate (61.25 to 70.75%) and Flubendiamdie (64.0 to 69.5%) compared with control (76%). Correlation studies revealed that seedling length was negatively correlated with Tebuconazole + Trifloxystrobin (-0.72), Ethion (-0.40), Emamectin benzoate (-0.39) and Flubendiamide (-0.37) where as Acetamiprid is neutral (0.08). Rootlets number was negatively correlated with Tebuconazole + Trifloxistrobin (r = -0.27) and Ethion (r = -0.14) while Acetamiprid (r = 0.24), Emamectin benzoate (r = 0.36) and Flubendiamide (r = 0.57) are positively correlated. Rootlets number per seedling was significantly (P=0.05) higher in all concentrations of Ethion (8.13 to 10.68), Acetamiprid (8.45 to 11.03), Emamectin benzoate (9.4 to 12.05) and Flubendiamide (2.9 to 10.43), where as in Tebuconazole + Trifloxystrobin combination (4.05 to 6.23) rootlets number was on par to the control (5.18).

Key words : *Seed germination, Seedling growth, Rootlets, Ethion, Scetamiprid, Flubendiamide, Emamectin benzoate, Tebuconazole and trifloxystrobin.*

Introduction

Okra (*Abelmoschus esculentus* L) is a very common vegetable in India. Among the states producing Okra, Andhra pradesh is in 2nd place after Gujarath

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(Horticulture Stat at a Glance 2017). Major constraints while producing okra in East Godavari district of Andhra Pradesh are pests like shoot and fruit borer, leaf hopper, okra stemflymites and white fly and major diseases likeyellow vein mosaic, powdery mildew and wilt.

Some crop protective agents inhibit germination of seed and seedling growth, and some enhance seedling growth at different concentrations. Seedling emergence was inhibited at higher concentrations of Tebuconazole was reported by Daibin Yang *et al*., 2014. Another study revealed that, exposure of tender tissue to ethion is genotoxiceffects on mitotic divisionsin onion (Lamsal *et al.,* 2010).

Tomato seed germination was decreased by emamectin benzoate, alpha-cypermethrin, lambda-cyhalothrin and imidacloprid, and this effect was more prominent at early stages of exposure (Shakirullah *et al*., 2016).

Seed treatment with fungicides and bio agents helped in increasing the seed germination by reducing the fungal incidence. Mashooda and Lokesh, in 2008 found, seeds of okra variety ArkaAnamika treated with fungicides namely Anucop, Bavistin, Captan, Dithane M 45 and Vitavax at different doses and in combinations reduced the incidence of seed mycoflora, thereby enhancing the seed germination percentage and vigour index of the seedlings. Shoot length, shoot weight, root length, root weight were significantly increased in both okra and sunflower. Where seeds of okra and sunflower were coated with *T. harzianum* using 2% of glucose. Gum arabic was found more effective in reducing infection by root rot fungi viz., *M. phaseolina*, *R. solani* and *Fusarium spp.* (Shahanaz *et al*., 2008). Oat growth was stimulated by benomyl at lower doses, whereas at higher dose detrimental to growth (Chen and Edwards, 2001).Coleoptile length was reduced by the application of insecticides in rice seedlings and root length was increased with rice seed exposing to fipronil (Moore and Kröger, 2010)

A survey was conducted to know the farmer practices to control the pests and diseases in Godavari delta region, from the surveyit is found that farmers are resorting to non-recommended insecticides and fungicides undermining the implications of the chemicals. From the survey some of the chemicals were shortlisted based on the use and chemical group to study 'Influence of crop protective agents on Okra (*Abelmoschus esculentus* L.) seed germination and seedling emergence in Green House'.

Materials and Methods

For this experiment, plastic trays were used where small holes were made at the bottom of the trays to drain off excess water. Trays were filled with washed sand up to the brim leaving one cm space on the top.

Okra seeds were sown in trays (Kameswara Rao, *et al.*, 2007) where seeds were placed in the soil not more than 1 cm deep from the surface. Each chemical treatment was replicated 4 times.Followed CRD design (Completely Randomized Design)

Location of the experiment was in Green House, Research Department, ITC, Rajahmundry, during kharif 2018.

Okra variety ArkaAnamica was used for the trial.

The following crop protective agents were shortlisted for the experiment (Table 1), namely Ethion, Acetamiprid, Tebuconazole and Trifloxistrobin, Fluebendiamide and Emamectin benzoate were used for the trial.

Sand trays were moisture every day with crop protective agent spiked solution (Table 2) of 0 % (Distilled water), 50% of RSD (Recommended Spray Dose), 100% RSD, 150 % RSD and 200 % RSD. Number of seedlings emerging out from the soil was taken on 5th 10th and final count on 15th day after sowing.

On 15th day germination count, partially germinated seed count and un-germinated seed count was taken. Seedling growth parameters of seedling total length, shoot length and root length were measured, and rootlets number per seedling were counted. From the germination count, partially germinated seed count and un-germinated seed count percentages were calculated using following equations.

Germination percentage = (Number of seedlingsemerged from the soil / Total Number of seeds used)*100

Partially germinated seed percentage = (Number of seeds partially emerged from the soil / Total Number of seeds used)*100

Un- germinated seed percentage = (Number of seeds not germinate/Total Number of seeds used)*100

Partially germinated seeds: Seeds produced radical but failed to produce plumule and unable to emerged out of soil are taken as partially germinated seeds.

Un-germinated seeds: Seeds unable to produce plumule and radical from the seed.

Finally the collected data were tabulated and statistically analysed. The statistical results were presented.

Results and Discussion

Seed Germination

From the statistical analysis (Table 3) of germination percent of the okra seed at different concentration it is evident that there is a significant (P= 0.05) reduction in germination percent with increasing concentration in all the crop protective agents tested. Lowest germination percent was recorded in Tebuconazole + Trifloxystrobin combination (4.5 to 22.75 %) followed by Ethion (17.5 to 48.75%), Acetamiprid (52.5 to 65.25%), Emamectin benzoate (61.25 to 70.75 %) and Flubendiamide (64 to 69.5%) compared to control (76 %). Similar observation of decrease in seed germination with early stage of exposure to pesticide was reported by Shakirullah Khan Shakir*et al*., 2016.

By analysing the partially germinated seed percent (Table 4) it is found that germination was significantly hindered by crop protective agents compared to control, but there was no significant variation in the emergence in relation to increasing concentration of the crop protective agents. Seed ling emergence was mostly effected in Tebuconazole + Trifloxystrobin combination (34.25 to 45.5 %) fol-

Table 1. Recommended spray dose for the shortlisted crop protective agents.

Active Ingredient	Crop Protective Agent type	Group	Recommended Spray Dose (RSD)
Ethion	Insecticide	Organophosphorus	2.5 mL/L
Flubendiamide	Insecticide	Ryanoid	0.3 mL/L
Emamectin Benzoate	Insecticide	Avermectin	0.4 g/L
Acetamiprid	Insecticide	Neonicotinoids	0.25 g/L
Tebuconazole and Trifloxystrobin	Fungicide	Azole & strobilurin	1.25 g/L

Table 2. Different concentrations of shortlisted crop protective agents (From 0 concentration to double the recommended dose on crop.

0% RSD (Control)	50 % RSD	100 % RSD	150% RSD	200% RSD
Acetamiprid				
0	0.125 g/L	0.25 g/L	0.375 g/L	0.5 g/L
Flubendiamide				
0	0.15 mL/L	0.3 mL/L	0.45 mL/L	0.6 mL/L
Emamectin Benzoate				
0	0.2 g/L	0.4 g/L	0.6 g/L	0.8 g/L
Tebuconazole+Trifloxystrobin				
0	0.625 g/L	1.25 g/L	1.875 g/L	2.5 g/L
Ethion				
0	1.25 mL/L	2.5 mL/L	3.75 mL/L	5 mL/L

Table 3. Germination percent at different concentrations

	Acetamiprid Benzoate	Emamectin	Flubendiamide	Tebuconazole+ Trifloxystrobin	Ethion
Control (0% RSD)	76	76	76	76	76
50% RSD	65.25	67.25	64	22.75	48.75
100% RSD	58.75	61.25	67.25	28.5	41.25
150% RSD	58.5	61.75	68	19	32.75
200% RSD	52.5	70.75	69.5	4.5	17.5
S Em ±	2.27	2.03	1.64	1.67	1.53
CD (P = 0.05)	6.83	6.11	4.95	5.05	4.61
CV (%)	7.29	6.02	4.77	11.11	7.07

lowed by Ethion (14.25 to 20.5 %), Emamectin benzoate (8.75 to 18%), Acetamiprid (11 to 13.25%) and Flubendiamide (11.5 to 14.5 %) compared to control (4.5 %).

Statistical analysis of un-germinated seed count (Table 5) it is clear that, germination of the okra seed was significantly (P= 0.05) affected with increase in concentration of all the tried crop protective agents tried except in Flubendiamide where significantly lowest un-germinated seed percent (16.5%) was observed at double the RSD concentration compared to 50% RSD treatment (24.5%). From the experiment highest un-germinated seed was observed in Ethion (35.25 to 68.25), followed by Tebuconazole + Trifloxystrobin combination (34.25 to 53.25%), Acetamiprid (21.5 to 36.5 %), Emamectin benzoate (14.75 to 27.5%) when compared with control (19.5). Similar observation of inhibited seed germination in wheat when exposed to Tebuconazole (Gao*et al*., 2000).

Correlation of shoot length, root length and lateral roots number in relation to Crop Protective agents:

Correlation analysis of seedling parameters like shoot length, root length, total length and number of rootlets (Table 6, Pic-Table 1) from the tap root showed that there is a negative correlation of shoot length to Tebuconazole + Trifloxystrobin (-0.71), Emamectin benzoate (-0.46), Flubendiamdie(-0.46) and ethion (-0.42) where as Acetamiprid was positively correlated (0.26). Root length was negatively correlated with Tebuconazole + Trifloxystrobin (-0.68), Acetamiprid (-0.27), while neutral by Emamectin benzoate and Flubendiamide, whereas

Table 4. Partially germinated seed percent at different concentrations

	Acetamiprid	Emamectin Benzoate	Flubendiamide	Tebuconazole + Trifloxystrobin	Ethion
Control (0% RSD)	4.5	4.5	4.5	4.5	4.5
50% RSD	13.25	18	11.5	43	16
100% RSD	12.5	13	11.75	34.25	15
150% RSD	12.75	10.75	14.5	45.5	20.5
200% RSD	11	8.75	14	42.25	14.25
S Em ±	1.79	2.61	2.18	3.24	3.04
CD(P=0.05)	5.40	7.86	6.58	9.76	9.17
CV (%)	33.15	47.39	38.81	19.09	43.29

Table 5. Un-germinated seed percent at different concentrations

	Acetamiprid	Emamectin Benzoate	Flubendiamide	Tebuconazole+ Trifloxystrobin	Ethion
Control (0% RSD)	19.5	19.5	19.5	19.5	19.5
50% RSD	21.5	14.75	24.5	34.25	35.25
100% RSD	28.75	25.75	21	37.25	43.75
150% RSD	28.75	27.5	17.5	35.5	46.75
200% RSD	36.5	20.5	16.5	53.25	68.25
S Em ±	3.396	2.58	3.07	4.01	3.61
CD(P=0.05)	10.24	7.79	9.27	12.08	10.87
CV (%)	25.16	23.93	31.06	22.29	16.89

Table 6. Correlation of crop protective on seedling (Shoot, root length and no of root lets).

Correlation	Shoot length	Root length	Total length	Root lets number/seedling
Ethion	-0.42	0.31	-0.40	-0.14
Emamectin Benzoate	-0.46	-0.06	-0.39	0.36
Tebuconazole + Trifloxystrobin	-0.71	-0.68	-0.72	-0.27
Acetamiprid	0.26	-0.27	0.08	0.24
Flubendiamide	-0.46	-0.06	-0.37	0.57

positively correlated with Ethion (0.31). Rootlet number per seedling was negatively correlated with Tebuconazole + Trifloxystrobin (-0.27) and Ethion (-0.14) while positively correlated with Flubendiamide (0.57), Emamectin benzoate (0.36) and Acetamiprid (0.24).

Total length of the seedling was negatively correlated with Tebuconazole + Trifloxystrobin (-0.72), Ethion (-0.40), Emamectin benzoate (-0.39) and Flubendiamide (-0.37) where as Acetamiprid is neutral (0.08).

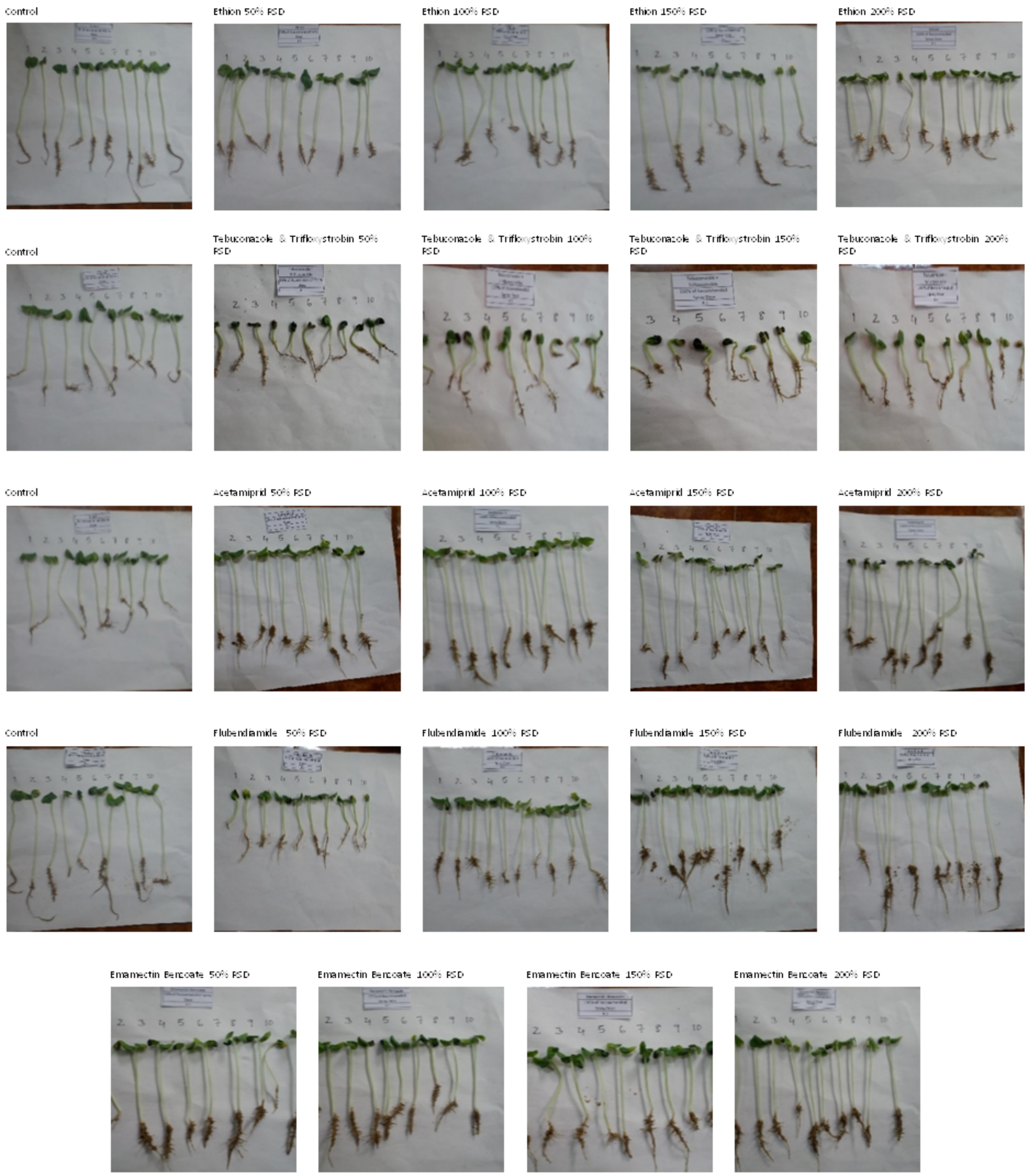

Fig. 1. Okra **s**eedling picture of different concentration of Ethion, Tebuconazole+ Trifloxystrobin, Acetamiprid, Flubendiamide and Emamectin benzoate.

Effect of crop Protective agents on okra emerging seedling growth

Ethion

From the statistical analysis (Table 7), seedling length was found to be significantly (P=0.05) lower in Ethion 1.25 mL/L, 2.5 mL/L, 3.75 mL/L and 5.0 mL/L concentrations (11.88, 11.14, 11.79 and 10.51 cm) compared to control (12.98 cm). Shoot length was lower in concentrations of 2.5 mL/L (8.40 cm) 5 ml/L (7.31 cm) where as concentrations of 1.25 mL/L and 3.75 mL/L didn't show significant difference compared to shoot length in control (9.24 cm). While root length was significantly lower in all Ethion concentrations 1.25ml/L (2.98 cm), 2.5 ml/L (2.74 cm), 3.75 ml/L (2.83 cm) and 5 mL/L (3.20 cm) compared to control (3.74 cm).

Number of rootlets per seedling were significantly increased in Ethion at 1.25 mL/L (10.68), 2.5 mL/L (8.88) and 5 mL/L (10.35) where as concentration at 2.5 mL/L didn't increase the rootlets number significantly compared with control (5.18). Gentil *et al.*, (1973) found Ethion inhibited germination of pollen tube in corn. Griffiths *et al.*, 1970 reported seedlings were not damaged by Ethion.

Acetamiprid

From the statistical analysis (Table 8), seedling

Table 8. Effect of Acetamipridconcentration on seedling length (shoot and root) and no of root lets per plant.

Treatment	Shoot length (cm)	Root Length (cm)	Total Length (cm)	Root lets number/ seedling
Control	9.24	3.74	12.98	5.18
Acetamiprid (0.125g/L)	9.46	3.81	13.28	10.00
Acetamiprid (0.25g/L)	9.70	4.35	14.05	10.20
Acetamiprid (0.375g/L)	10.11	3.24	13.35	11.03
Acetamiprid (0.5g/L)	10.19	3.26	13.45	8.45
S Em. ±	0.14	0.07	0.15	0.59
CD(P=0.05)	0.41	0.20	0.46	1.78
CV (%)	2.77	3.64	2.28	13.19

Table 9. Effect of Flubendiamide concentration on seedling length (shoot and root) and no of root lets per plant.

Treatment	Shoot length (cm)	Root Length (cm)	Total Length (cm)	Root lets number/ seedling
Control	9.24	3.74	12.98	5.18
Flubendiamide (0.15 mL/L)	8.20	3.73	11.93	2.9
Flubendiamide (0.3 mL/L)	7.70	3.66	11.36	8.03
Flubendiamide (0.45 mL/L)	7.03	3.31	10.34	8.58
Flubendiamide (0.6 mL/L)	7.64	3.79	11.43	10.43
S Em. ±	0.17	0.09	0.23	0.56
CD(P=0.05)	0.53	0.28	0.69	1.70
CV (%)	4.37	5.11	3.97	16.08

Table 10. Effect of Emamectin benzoateconcentration on seedling length (shoot and root) and no of root lets per plant.

Treatment	Shoot length (cm)	Root Length (cm)	Total Length (cm)	Root lets number/ seedling
Control	9.24	3.74	12.98	5.18
Emamectin Benzoate (0.2g/L)	7.81	3.39	11.20	9.4
Emamectin Benzoate (0.4g/L)	7.35	3.30	10.65	12.05
Emamectin Benzoate (0.6g/L)	7.10	3.60	10.70	10.15
Emamectin Benzoate (0.8g/L)	7.48	3.45	10.92	9.86
S Em. ±	0.14	0.09	0.19	0.40
CD(P=0.05)	0.42	0.28	0.57	1.20
CV (%)	3.53	5.33	3.32	8.52

length was found to be significantly (P=0.05) higher in Acetamiprid 0.25 g/L (14.05 cm) and 0.5 g/L (13.45 cm) while Acetamiprid at 0.125 g/L and 0.375 g/L didn't show any significant variation compared with control (12.98 cm). Shoot length was higher in concentrations of 0.25g/L (9.70 cm), 0.375g/L (10.11 cm) and 0.5 g/L (10.19 cm) where as concentration at 0.125g/L was on par with the control (9.24cm). Root length was significantly lower at higher concentrations of 0.375 g/L (3.24 cm) and 0.5 g/L (3.26 cm) and at lower concentration of 0.25g/L root length was higher (4.35 cm), whereas at 0.125 g/L concentration didn't show any significant difference (3.81cm) compared to control (3.74 cm).

Number of rootlets per seedling were significantly higher in all the concentration of 0.125 g/L (10.00), 0.25g/L (10.20), 0.375 g/L(11.03) and 0.5g/L (8.45) compared with control (5.18). Gnanadhas and Johnson (2012) reported that application of Acitamiprid increased soluble protein content and chlorophyll in okra plants.

Flubendiamide

From the statistical analysis of the data, seedling length was found to be significantly (P=0.05) lower in all concentrations of 0.15 ml/L (11.93 cm), 0.3 mL/L (11.36 cm), 0.45 ml/L (10.34 cm) and 0.6 mL/L (11.43 cm) compared with control (12.98 cm). Shoot length was reduced with increase in concentration of Flubendiamide 0.15mL/L (8.2cm), 0.3mL/L (7.7 cm), 0.45 mL/L (7.03cm) and 0.6 mL/L (7.64 cm) compared with control (9.24cm). While root length was reduce at concentration of 0.45 mL/L (3.31cm) where as the concentrations 0.15mL/L (3.74cm), 0.3 mL/L (3.66 cm) and 0.6ml/lt (3.79 cm) are on par with control (3.74 cm).

Number of rootlets per seedling are significantly lower in 0.15 mL/L (2.9) whereas at 0.3 mL/t (8.03), 0.45ml/L (8.58) and 0.6 mL/L (10.43) were higher compared to control (5.18). Deng Li'nan*et al*., (2011) observed Flubendiamid stimulated growth in rice seedlings.

Emamectin Benzoate

From the statistical analysis (Table 10) of shoot, root and seedling total length in different concentrations of Emamectin Benzoate shoot length was found to be significantly decreased in 0.2 g/L (7.81 cm), 0.4g/L (7.35 cm), 0.6 g/L (7.10 cm) and 0.8 g/L (7.48 cm) compared to control (9.24cm). Root length was smaller in 0.2g/L (3.39 cm), 0.4g/L (3.30 cm), and 0.8g/L (3.45 cm) while 0.6g/L (3.60 cm) recorded on par with control (3.74 cm). Seedling length was found to be significantly lower in 0.2 g/L (11.20 cm), 0.4g/L (10.65 cm), 0.6g/L (10.70 cm) and 0.8g/lt (10.92 cm) compared to control (12.98 cm).

Rootlets number per seedling recorded significantly higher in all the tried concentrations of Emamectin benzoate compared to control. Rootlets number recorded highest in 0.4 g/L (12.05) followed by 0.6 g/L (10.15), 0.8 g/L (9.86) and 0.2 g/L (9.4) when compared with control (5.18).

Shakirullah Khan *et al*., (2016) observed Emamectin Benzoate reduced the growth when applied in higher concentration than the recommended dose, but at lower doses had some stimulatory effects on growth in tomato crop.

Tebuconazole + Trifloxystrobin combination

From the statistical analysis (Table 11), shoot length, root length and total seedling length were found significantly lower compared to control.

Table 11. Effect of Tebuconazole + Trifloxystrobin concentration on seedling length (shoot and root) and no of root lets per plant.

Treatment	Shoot length (cm)	Root Length (cm)	Total Length (cm)	Root lets number/ seedling
Control	9.24	3.74	12.98	5.18
Tebuconazole +Trifloxystrobin (0.625 g/L)	3.03	1.68	4.70	6.23
Tebuconazole +Trifloxystrobin (1.25g/L)	2.94	1.41	4.35	4.10
Tebuconazole +Trifloxystrobin (1.875 g/L)	2.31	1.04	3.35	3.30
Tebuconazole +Trifloxystrobin (2.5g/L)	2.70	1.25	3.95	4.05
S Em. ±	0.10	0.09	0.13	0.61
CD(P=0.05)	0.31	0.27	0.40	1.83
CV (%)	5.14	9.68	4.50	26.57

Rootlets number was found significantly lower in 1.875 g/L (3.30) of Tebuconazole + Trifloxystrobin combination, while the 0.625 g/L (6.23), 1.25 g/L (4.10) and 2.5 g/L (4.05) were on par compared to control (5.18). Daibin Yang *et al.,*(2014) reported similar finding that Tebuconazole inhibited germination in maize crop. Triazoles reduce shoot growth by inhibiting production of gibberellins (Wilhelm *et al.,* 1987).

Conclusion

From the green house experiment in sand culture it is clear that Okra seed germination was reduced with increasing crop protective agent concentration. Lowest germination percent was recorded in Tebuconazole + Trifloxystrobin combination (4.5 to 22.75 %) followed by Ethion (17.5 to 48.75%), Acetamiprid (52.5 to 65.25%), Emamectin benzoate (61.25 to 70.75 %) and Flubendiamide (64 to 69.5%) compared to control (76 %).

Seedling emergence is also effected by the crop protective agent and application concentration. Partially germinated seeds percent was in the order of Tebuconazole + Trifloxystrobin combination (34.25 to 45.5 %) followed by Ethion (14.25 to 20.5 %), Emamectin benzoate (8.75 to 18%), Acetamiprid (11 to 13.25%) and Flubendiamide (11.5 to 14.5 %) compared to control (4.5 %).

From the experiment highest un germinated seed was observed in Ethion (35.25 to 68.25), followed by Tebuconazole + Trifloxystrobin combination (34.25 to 53.25%), Acetamiprid (21.5 to 36.5 %), Emamectin benzoate (14.75 to 27.5%) when compared with control (19.5) where as Flubendiamide recorded ungerminated seed on par with control.

Seedling shoot length was negatively correlated with Tebuconazole + Trifloxystrobin (-0.71), Emamectin benzoate (-0.46), Flubendiamdie (-0.46) and Ethion (-0.42) where as Acetamiprid was positively correlated (0.26). Root length was negatively correlated with Tebuconazole + Trifloxystrobin (-0.68), Acetamiprid (-0.27), while neutral by Emamectin benzoate and Flubendiamide, whereas positively by Ethion (0.31). Rootlet number per seedling was negatively correlated with Tebuconazole + Trifloxystrobin (-0.27) and Ethion (-0.14) while positively correlated with Flubendiamide (0.57), Emamectin benzoate (0.36) and Acetamiprid (0.24).

Seedling length was negatively correlated with Tebuconazole + Trifloxystrobin (-0.72), Ethion (-0.40), Emamectin benzoate (-0.39) and Flubendiamide (-0.37) where as Acetamiprid is neutral (0.08).

Rootlets number in all the crop protective agents tested were significantly higher than control except in Tebuconazole + Trifloxistrobin. Rootlets number was negatively correlated with Tebuconazole + Trifloxistrobin (-0.27) and Ethion (-0.14) while Acetamiprid (0.24), Emamectin benzoate (0.36) and Flubendiamide (0.57) are positively correlated.

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