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EFFECT OF DITHANE M-45 ON GROWTH AND DEVELOPMENT OF *Abelmoschus esculentus* (OKRA)

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ABSTRACT

The experiment was conducted to evaluate the effect of Dithane M-45 on the germination, growth & development of *Abelmoshchus esculentus* during its whole life cycle selecting the variety Azad bhindi-1. The seeds were treated with 0.1%, 0.2%, 0.3%, 0.4% & 0.5% concentration of Dithane M-45 before sowing in the experimental plot and the resulting plants were considered as M_1 generation. The seeds obtained from M_1 generation under different treatment were further treated with the corresponding concentration of Dithane M-45 to obtain M_2 generation. The result showed an increase in the germination percentage of seeds, seedling survival and plant height among 0.3% & 0.4% treatment concentration of Dithane M-45 while there is no inducing effect on emergence of branches however 0.4% & 0.5% concentration may induce one or two branching in few plants. The number of pod formation per plant and weight of 100 seeds on the treatment of various concentration of Dithane M-45 showed a decreasing trends with increasing the treatment concentration in both the generation in comparison to control but the losses incurred were slightly recovered in M_2 generation. The reduction in the number of pods per plant & weight of 100 seeds results into the reduction of crop yield. Therefore, the result obtained permit limited use of Dithane M-45 in very low concentration i.e. 0.2% & 0.3% for the treatment. Above 0.3% treatment concentration of Dithane M-45 have deleterious impact on the development & yield of *Abelmoschus esculentus*.

KEYWORDS : *Abelmoschus esculentus,* Dithane M-45, Morphology, development, yield

Vegetables being a rich and cheap source of vitamins and minerals, occupy an important place in the food basket of Indian consumers. Therefore, it occupy a significant place in human diet because it's vitamins and minerals are essential for human health and growth.

Okra (Bhindi or lady's finger) is an important summer and rainy season vegetable crop which is rich in carbohydrates, Protein and Vitamin C. The essential and non-essential amino acids that okra contains are comparable to that of soybean which is vital part of human diet.

Okra mucilage is suitable for industrial and medicinal applications. Industrially, okra mucilage is usually used for glace paper production and also has a confectionery use (Akinyele and Temikotan, 2007). Okra has found medical application as a plasma replacement or blood volume expander (Savello et al., 1980, Markose and Peter 1990, Lengsfeld et al., 2004, Adetuyi et al., 2008, Kumar et al., 2010). Okra oil is suitable as Biofuel (F. Anwer, 2009)

On the other hand fibres obtained from the stem as well as pods used as the substitute for jute. It is also used in making paper and textile. So that okra is the most important vegetable crop for human being but these vegetable crops are heavy loosed every year by several pest and mycofloral disease such as verticillium wilt, yellowing and wilting of the leaves, powdery mildew, leaf spot and root-knot nematodes etc. Tanweer, 1982 reported that fungicides treated seed improves seed health, plant stand and crop yield together with the control on seed borne diseases. To increase the yield of plants, agrochemicals are used by the farmers. But it is observed through many studies that it's use can also cause many serious problems for human beings, environment, water bodies, plants and soil quality too.

Krol et. al., 2000 reported that the pesticides are chemical substances that are widely used against plant pests and diseases. Pesticides have been used as one of the most important inputs to ensure the quality and quantity of their crops to feed a growing population (Matthew, 2006).The use of pesticides in commercial agriculture has led to an increase in farm productivity. The systemic fungicides Bavistin [carbendazim] Vitavax [carboxin], and the non-systemic fungicides Indofil M-45 [mancozeb+thiophanate-methyl], Captan and zineb were tested at concentrations of 0.5, 1.0, 1.5 and 2.0% as seed treatment of okra. Indofil M-45 and Captan were superior for the inhibition of the seed borne pathogens and increasing the seed germination at 2% concentration (Thippeswamy et al., 2007).However several scientist reported that the negative effect of fungicides on sunflower growth and phosphorus content. It was found that as the concentration of the fungicides increased, the growth decreased and minimum growth was observed in 1%

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concentration of Bavistin and Dithane M-45. Both fungicides had deleterious effect on mycorrhizal spore number and percentage mycorrhizal root colonization (Ashok Aggarwal et al. 2005, Buts et al., 2013).

Many worker reported about health hazards, undesirable side effects and environmental pollution caused by the continuous use of synthetic chemical pesticides (Nas, 2004). Heavy pesticide use in food crops especially rice has triggered wide spread farmer health problems in Asia (Antle and Pingali,1994). Bazzi et al., 2009 concluded by their experiment on green beans that there is a need for careful control of the spraying doses of dithiocarbamate fungicide.

The present study was under taken to evaluate the effect of Dithane M-45 on growth and development of *Abelmoschus esculentus* (okra) during their whole life cycle in field condition. Parameters taken for study are seed germination, plant height, number of branches, time taken for initiation of flowering, number of pods per plants, period of harvesting & weight of seeds in M_1 & M_2 generations.

MATERIALS AND METHODS

Okra is an important member of the family Malvaceae with 2n=8x=72 to 144 chromosomes and is polyploid in nature. The seeds of *Abelmoschus esculentus* were purchased from Saac Sabji Anusandhan Kendra, Kanpur. Healthy seeds of equal size & shape were selected for treatment with Dithane M-45. Diathane M-45 is a non-systemic organic fungicide. It belongs to the chemical group of ethylene bisdithiocarbamates. It is a metallo co-ordination complex with dithiocarbamate and exists as polymers. It belongs to the sub group Mancozeb which is a coordination complex with both zinc and manganese. The IUPAC name is *Manganese ethylenebis* (dithiocarbamate) (*polymeric*) complex with zinc salt with the molecular formula ($C_4 H_6 MnN_2 S_4$) x ($C_4 H_6 N_2 S_4 Zn$). Before sowing of seeds in the experimental plots, seeds were soaked overnight in distilled water. Then soaked 100 seeds were placed in each petridishes containing concentration of 0.1%, 0.2%, 0.3%, 0.4%, & 0.5% of Dithane M-45 for 6 hours in the laboratory and after treatment these seeds were allowed to germinate in petri-dishes lined with filter paper and cotton wools. After radicle emergence, they were sown in experimental field under controlled conditions. 100 seeds soaked in distilled water for overnight were sown in experimental field as control. The seeds were shown in lines keeping a distance between rows is 75-80 cm. Rows in east-west direction that will best capture the sunlight. Distance between rows will provide space for ease in movement during spraying, side dressing and harvesting. On the contrary, in the field, the emergence of hypocotyls and cotyledons above the surface of the soil had been taken as an index of germination. Arrangement was made for regular operation and irrigation. Neither chemical nor other fertilizers were used. This was done to avoid confusion. In the field, seeds were shown in the first week of July and final harvesting was done during the period of the November. In between the above periods, morphological characters were studied with respect to plant height, date of first flowering, number of pods, etc.

The seeds were collected after harvesting and stored in glass containers separately with specific symbols & considered as M_1 generation. Weight of hundred seeds was taken separately obtained from control as well as treated plants and seed quality was also observed. The stored seeds of M_1 generation were again treated with the corresponding concentration i.e. 0.1%, 0.2 %, 0.3 %, 0.4% and 0.5% of chemical taken for study by the same methods as mentioned above for M_1 generation and sown in the prepared field. Now this second generation was considered as M_2 generation. The morphological as well as reproductive characters were observed like M_1 generation. The phenotypic variability and their frequencies were collected & finally the rate of induced variability of quantitative characters in M_1 and M_2 generations were calculated.

RESULTS AND DISCUSSION

The results obtained in the present study have been shown in table 1 & 2 and figure, 1. (A-E) and expressed together with the discussion in separate heading as under-

Effect of Ditnane M-45 on Seed Germination

In M_1 generation, the average seed germination are 88%, 90%, 90%, 92% & 76% in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration treated seed respectively in

comparison to 90% among untreated seeds.

In M_2 generation the average seed germination are 90%, 86%, 88%,88% & 82%in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration treated respectively in comparison to 100% among untreated seeds.

Therefore, data clearly showed best percentage germination among untreated healthy seeds. However thereafter the germination percentage is maximum among 0.3% & 0.4% treatment concentration treated seeds of Azad bhindi-1. But @ 0.5% treatment concentration treated seeds suddenly showed very higher decline in germination percentage. Which are 15.33% & 18% in M_1 & M_2

Table 1 : Effect of Dithane M-45 on Quantitative Characters in *Abelmoschus esculentus* Variety Azad Bhindi-1 in M_1 Generation

M_1 GENERATION

Treatment	Germination (%) in field	Seedling survival (%) in field	Height of native plants(m) ± (S.D.)	No. of branches per plant ±(S.E.)	Days taking 1st flowering	Period of harvesting	No. of pod per plants ± (S.D.)	Weight of 100 seeds(gram)± (S.D.)
Control	90	84	1.2 ±0.16	Nil	48-55	56-113	18.1 ±3.36	5.384 ±0.09257
0.1%	88	84	1.37 ±0.15	Nil	46-54	55-113	18.0 ±1.94	5.348 ±0.70795
0.2%	90	84	1..38 ±0.20	Nil	48-55	56-113	16.8 ±2.89	5.364 ±0.06964
0.3%	90	86	1.47 ±0.14	Nil	50-57	59-113	14.5 ±2.40	5.277 ±0.04648
0.4%	92	86	1.30 ±0.28	0.10 ±0.05	50-57	59-113	13.6 ±3.0	5.09 ±0.05158
0.5%	76	70	1.24 ±0.24	0.05 ±0.009	50-57	59-113	12.5 ±2.68	5.091 ±0.07543

Table 2 : Effect of Dithane M-45 on Quantitative Characters in *Abelmoschus esculentus* Variety Azad Bhindi-1 in M_1 Generation

M_2 GENRATION

Treatment	Germination (%) in field	Seedling survival(%) in field	Height of native plants(m) ± (S.D.)	No. of branches per plant ±(S.E.)	Days taking 1st flowering	Period of harvesting	No. of pod per plants ±(S.D.)	Weight of 100 seeds(gram)± (S.D.)
Control	100	80	1.1 ±0.13	Nil	48-55	57-120	18.42 ±3.14	5.346 ±0.10995
0.1%	90	80	1.22 ±0.16	Nil	48-55	57-120	16.0 ±3.42	5.392 ±0.07662
0.2%	86	78	1.29 ±0.18	Nil	52-59	61-120	16.0 ±2.84	5.307 ±0.1982
0.3%	88	82	1.18 ±0.15	Nil	52-59	61-120	15.280 ±4.88	5.206 ±0.08056
0.4%	88	82	1.15 ±0.18	0.06 ±0.06	52-59	61-120	14.84 ±2.16	4.872 ±0.04
0.5%	82	72	1.13 ±0.13	0.02 ±0.02	56-63	63-120	14.0 ±2.2	4.319 ±0.11649

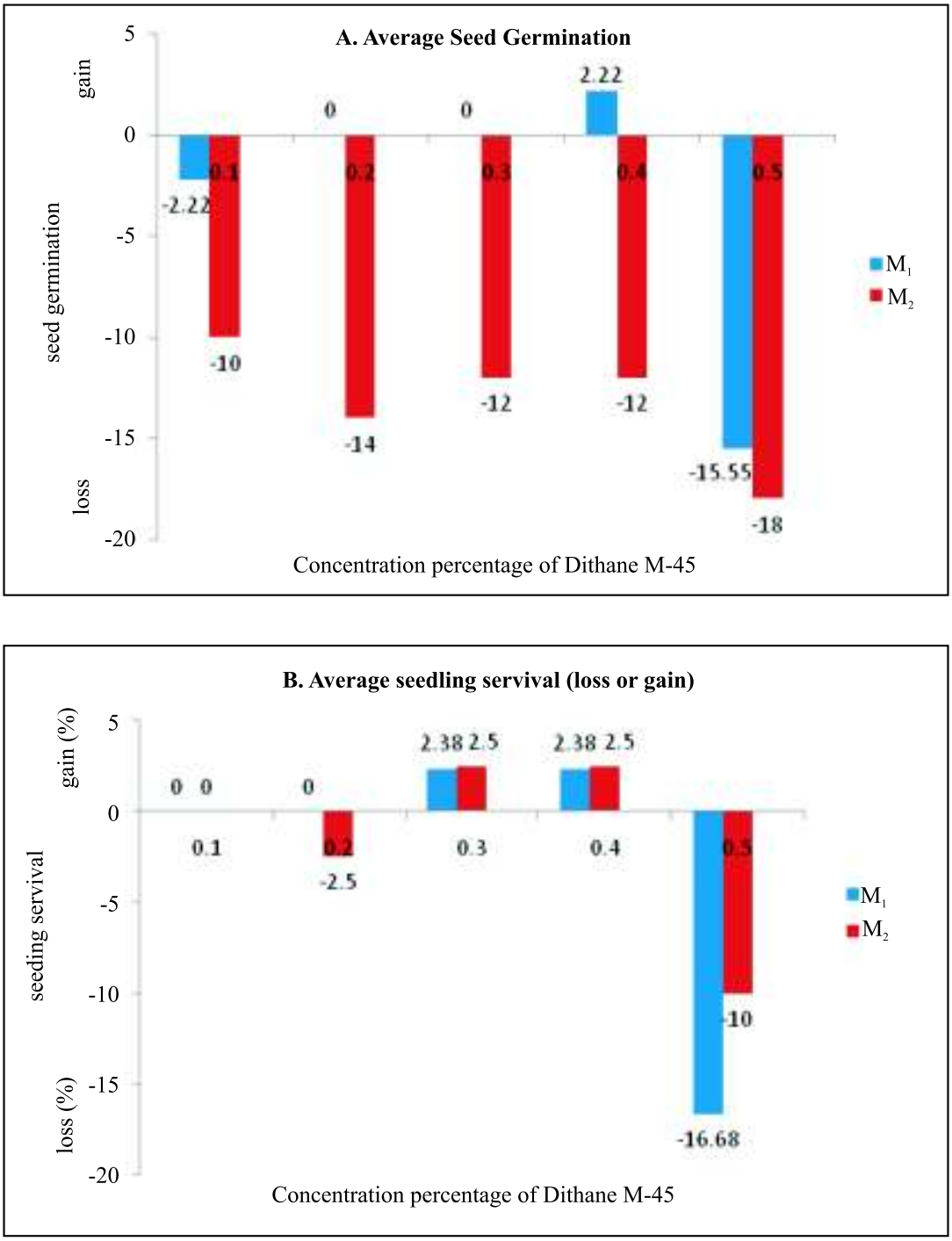

Figure 1(A-F): Percentage Loss or Gain in Respect to Control in M_1 & M_2 Generation in Dithane M-45 Treated Seeds

generations respectively (Mashooda Begum and S. Lokesh, 2008). Thus the observed data permits limited use of Dithane M-45 in very low concentration i.e. up to 0.4% treatment concentration. Above 0.4% treatment concentration adversely affect the germination process in *Abelmoschus esculentus*.

Effect of Dithane M-45 on Seedling Survival :

In M_1 generation, the average seedling survival are 84%, 84%, 86%, 86% & 70% in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration of Dithane M-45 respectively in comparison to 84% under control seed.

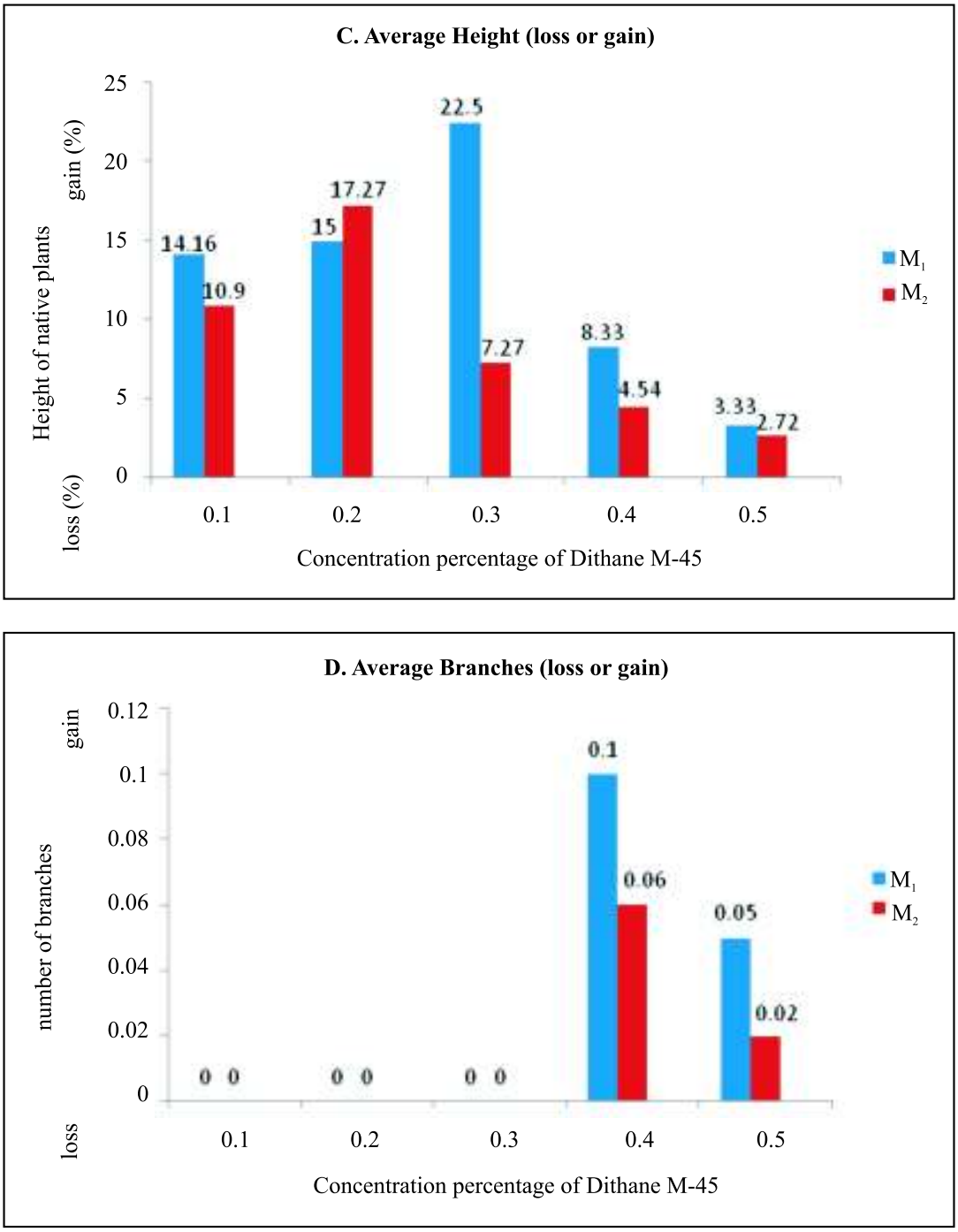

Figure 1(A-F): Percentage Loss or Gain in Respect to Control in M_1 & M_2 Generation in Dithane M-45 Treated Seeds

In M_2 generation, the average seedling survival are 80%, 78%, 82%, 82% & 72% in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration respectively in comparison to 80% under control seed.

Thus, there is a reduction of 22.22% & 28% in seedling survival in comparison to germination percentage in both generations i.e. M_1 & M_2 respectively in the case of Azad bhindi-1 variety under the stress of 0.4 & 0.5% treatment concentration of Dithane M-45.

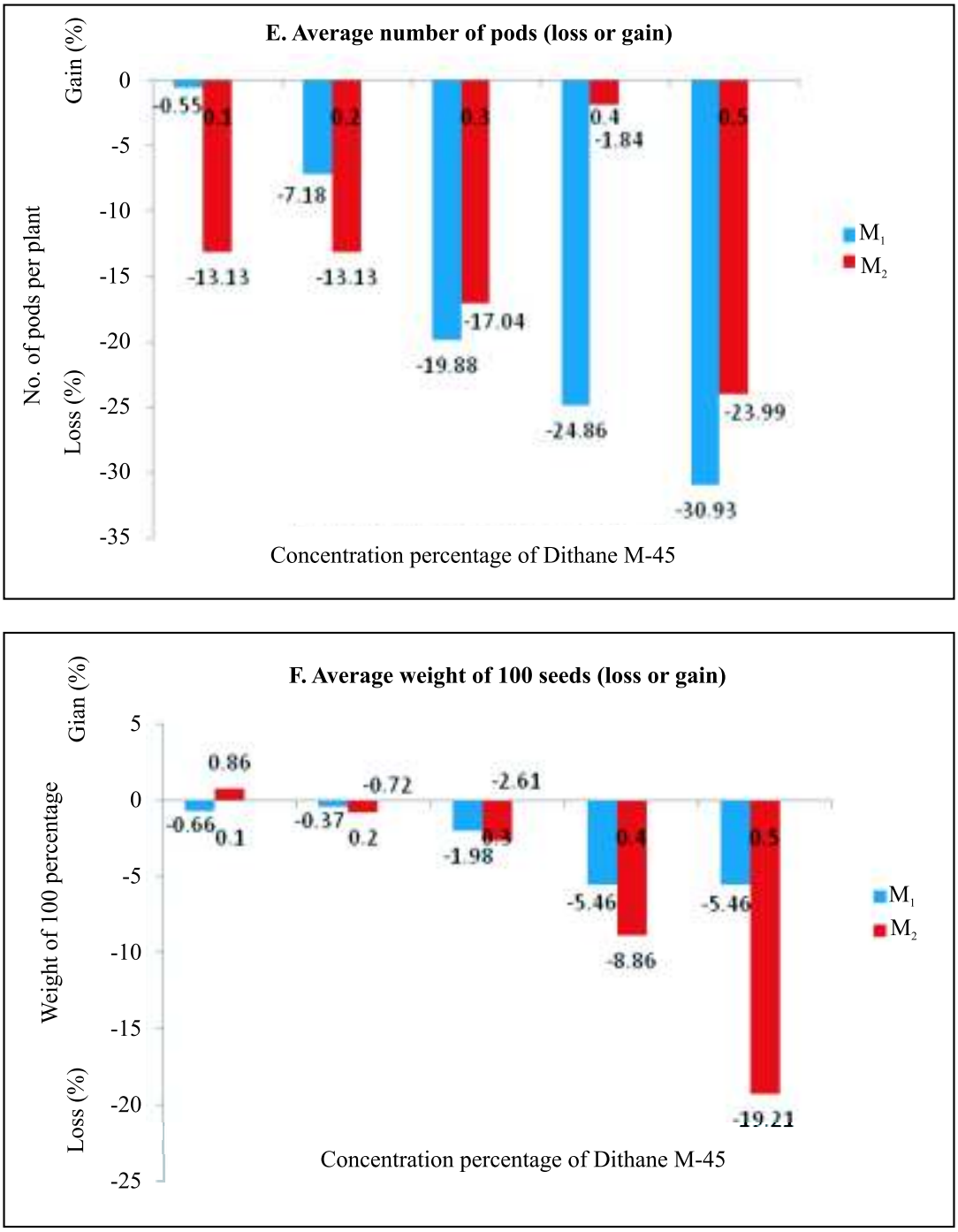

Figure 1(A-F): Percentage Loss or Gain in Respect to Control in M_1 & M_2 Generation in Dithane M-45 Treated Seeds

Effect of Dithane-M 45 on Plant Height

It is found that increasing treatment co ncentration of the chemical from 0.1% to 0.3% increase the plant height in M_1 generation but in case of M_2 generation the increasing trend in the plant height is observed up to 0.2% treatment concentration only. Maximum reduction of plant height is observed at 0.5% treatment concentration in both generation of Azad bhindi-1

Above findings match with the Ashok Aggarwal (2005), who observed that as the concentration of the

fungicides increased, the growth decreased and minimum growth was observed in 1% concentration of Bavistin as well as of Dithane M-45.

Mohd. Aamil et al., 2004 observed that when the seeds treated with the lower concentration of fungicides, it significantly increased the nodulation.

Effect of Dithane M-45 on Number of Branches Per Plant

There is no inducing effect on the emergence of branches in case of 0.1%, 0.2% & 0.3% treatment concentration treated as well as control in both M_1 & M_2 generation. However 0.4% & 0.5% treatment concentration of Dithane M-45 has little inductive effect regarding branching in both M_1 & M_2 generation. Not all but some plants growing under 0.4% & 0.5% treatment concentration showed emergence of one or two branches

Thus it can be concluded that there is no significant effect of Dithane M-45 on emergence of branches however 0.2%, 0.3%, 0.4% & 0.5% treatment concentration may induce one or two branching in few plants. Hence induction of branching varies from variety to variety under different treatment.

Effect of Dithane M-45 on First Flowering

In M_1 generation of Azad bhindi-1, the first flowering started for 46 to 54, 48 to 45, 50 to 57, 50 to 57 & 50 to 57 days in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration respectively in comparison to 48 to 45 days under control.

In M_2 generation of Azad bhindi-1, the first flowering started for 48 to 55, 52 to 59, 52 to 59, 52 to 59 & 56 to 63 days in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration respectively in comparison to 48 to 55 days under control.

Therefore, it is found that in M_1 generation of Azad bhindi-1, the maximum time taken for first flowering was recorded 50 to 57 days at 0.3%, 0.4% & 0.5% treatment concentration.

In M_2 generation, the populations raised from the seeds collected from M_1, the first flowering are also delayed at 0.2%, 0.3%, 0.4% & 0.5% treatment concentration but its maximum time taken for first flowering is at 0.5% treatment concentration.

Thus, the data clearly indicate that there is no significant effect of Dithane M-45 on the initiation of flowering however it may slightly delayed with increasing the treatment concentration of Dithane M-45 in both generations.

Effect of Dithane M-45 on Days Taken for Harvesting

There is no significant change regarding period of harvesting in M_1 & M_2 generation of Azad bhindi-1 in comparison to control.

Effect of Dithane M-45 on Number of Pods Per Plants

In M_1 generation, the average number of pods per plants of Azad bhindi-1 are 18, 16.8, 14.5, 13.6 & 12.5 in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration respectively in comparison to 18.1 under untreated seeds.

In M_2 generation the average number of pods per plants of Azad bhindi-1 are 16, 16, 15.28, 14.84 & 14 in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration respectively in comparison to 18.1 under untreated seeds.

Thus, there is a decrease of 0.55%, 7.18%,19.88%, 24.86% & 30.93% in pod formation in M_1 generation under 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration respectively of Dithane M-45 treated seeds in comparison to control while there is a decrease of 13.13%, 13.13%, 17.04%, 19.43% and 23.99% in M_2 generation in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment concentration respectively in comparison to control.

Therefore, it can be concluded that with increasing the treatment concentration the average number of pod formation decrease. However the decrease percentage in M_2 generation is comparatively less in comparison to M_1 generation in corresponding treatment concentration. It may happen due to development of tolerance in M_2 generation towards the Dithane M-45.

Effect of Dithane M-45 on Weight of 100 Seeds

In M_1 generation, the average weight of 100 seeds of Azad bhindi-1 are 5.348gm, 5.364gm, 5.277gm, 5.09gm & 5.091gm in 0.1%, 0.2%, 0.3%, 0.4% &0.5% treatment concentration respectively in comparison to 5.384gm under untreated seeds.

In M_2 generation, the average weight of 100 seeds of Azad bhindi-1 are 5.392gm, 5.307gm, 5.206gm, 4.872gm & 4.319gm in 0.1%, 0.2%, 0.3%, 0.4% & 0.5% treatment

concentration respectively in comparison to 5.346gm under untreated seeds.

Thus, with increasing the treatment concentration, the weight of 100 seeds decreases in both generations which are maximum i.e. 19.2% in 0.5% treatment concentration treated in M2 generation.

Thus, from the above finding, there is a gradual loss of weight in 100 seeds according to the increasing concentration of Dithane M-45 in both generations of Azad bhindi-1. The maximum reduction of weight of 100 seeds are at 0.4% & 0.5% treatment concentration in M2 generation.

Hence, reduction in the number of pod formation and loss in weight together reduces the crop yield. Thus, Dithane M-45 treatment finally affects the yield of Abelmoschus esculentus in comparison to control.

On the basis of the data recorded in the present investigation, it may be inferred that the treatment concentration up to 0.3% of Dithane M-45 has positive response on the morphological features & is safe however, Dithane M-45 deleteriously affect the developmental process & reduces the yield. The yield reduces more in the treatment concentration above 0.3% of Dithane M-45. Hence, the obtained result permit limited use of Dithane M-45 in very low concentration i.e. up to 0.3% for treatment.

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