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EVALUATION OF FERTILIZERS AND MICRONUTRIENTS FOR THE CONTROL OF MANGO HOPPER

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ABSTRACT : Effect of fertilizers and micronutrients on hoppers showed that the treatment 1.5 kg N + 1 kg P_2O_5 and 1 kg K_2O along with Cu, Zn, B and S applied was most effective in checking multiplication of hopper population, whereas the treatment with 2 kg N only was least effective as maximum hopper population (20.06 hopper per panicle in 3rd observation) was recorded here. However, in rest of the treatments, hopper population was more or less equal to control. Maximum fruit set (189.75 and 139.25 fruits per 100 panicles) was observed in the treatment where 1.5 kg N, 1.0 kg P_2O_5 and 1 K_2O were used along with Cu, Zn, B and S that was significantly different from control followed by the fruit set in recommended dosage. Minimum fruit set (116.00 and 105.25 per 100 panicles) was recorded in control. Fruit harvested and fruit weight were again highest (110.25 and 21 kg per 100 panicles) where 1.5 kg N, 1.0 kg P_2O_5 and 1 kg K_2O were used along with Cu, Zn, B and S followed by fruit yield in recommended dosage. Lowest fruit number and fruit weight (100.25 and 16.30 kg per 100 panicles) were observed in treatment where only 2.0 kg N was used.

Key words : *Mango hopper, fertilizers, micronutrients, management.*

The mango (*Mangifera indica* Linn.), known as king of fruits is the single most important tropical/ subtropical fruit in the world (Rahman *et al.,* 10). Over the period of time insect pests have been the key factors in healthy mango production, in terms of quality as well as quantity (Dwivedi *et al.,* 4; Rahman and Kuldeep, 12; Rahman *et al.,* 14). Tandon and Vergheese (18) reported more than 400 pests, which attack mango. Among these, the mango leaf hoppers, *Amritodus atkinsoni* (Leth), *Idioscopus clypealis* (Leth.) and *Idioscopus niveosparasus* (*nitidulus*) Leth. (Cicadellidae : Homoptera) are most severe all over India on the basis of extent of damage during the flowering and fruiting periods (Rahman *et al.,* 14; Rahman *et al.,* 8; Rahman *et al.,* 9 ; Rahman *et al.,* 13). Healthy and vigorous plants are able to resist the attack of a given pest better and for a longer period than the sickly, under nourished plants (Atwal and Dhaliwal, 1). Crop plants high in nitrogen content are well known to attract more number of insect species as such plant tissues are likely to be more succulent to the feeding of insects, particularly in the case of sap feeders (Natr, 7).

A reduction in the incidence of a number of insect pests including, *Spodoptera litura,* green leaf hopper, brown plant hopper, white backed plant hopper, aphid, thrips etc. following increasing application of K either singly or in combination with P has been reported (Dhaliwal and Arora, 3).

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MATERIALS AND METHODS

The experiment was conducted at the Horticultural Research Centre, Patharchatta, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (Udham Singh Nagar), Uttarakhand on mango trees cv. Dashehari in the age group of 25-30 years. The purpose of this investigation was to see the impact of different treatments of fertilizers and micronutrients on hopper population and subsequently on fruiting and yield.To study this aspect, 7 treatments and 4 replications were taken where one tree was considered as one replication. The 1st treatment consisted of recommended dosage of NPK *i.e.* 1 kg N, 0.5 kg P_2O_5 and 0.75 kg K_2O. The 2nd treatment consisted 1.5 kg N, 1 kg P_2O_5 and 1 kg K_2O along with Cu, Zn, B and S, whereas 3rd treatment consisted of 500 g NPK along with Cu, Zn, and B. The 4th treatment consisted of only Cu, Zn, B and S, whereas only 2 kg N was used in 5th treatment. The 6th one was having only Biozyme (aminoacids as micro nutrients obtained from Wockhardt Ltd., Mumbai) and the 7th one was control where no fertilizer was applied.

The N, P_2O_5 and K_2O were available as urea (46%), single super phosphate (16%) and muriate of potash (60%). Cu, Zn and B were available in the salt form whereas S was available in dust form. After clearing the soil of the canopy area, the fertilizers were applied manually and mixed with the soil in the month of October 2000. For Biozyme, foliar spray was done. Ploughing, irrigation and spraying of insecticides etc. were carried out as per schedule. Observations of hopper population on 25 panicles per tree were recorded. Fruit set at pea size, marble size and full size as well as fruit weight per 100 panicles of each replication were also recorded.

RESULTS AND DISCUSSION

Hopper population on 9.3.2001(1st observation) was lowest (5.53 hoppers/panicle) in 2nd treatment followed by 7.12 hoppers/panicle in 1st treatment, which were significantly different from control (Table 1). The hopper population was maximum (11.85 hoppers/ panicle) in 5th treatment where only 2 kg N was applied followed by 9.69 hoppers per panicle in control, which were at par. The hopper populations were 8.52 and 7.91 per panicle in 3rd and 4th treatment, respectively which were at par. Hopper population as recorded on 22.3.2001(2nd observation) was lowest (4.74 hoppers/ panicle) in 2nd followed by 6.10 and 6.27 hoppers/ panicle in 1st and 6th treatments which were at par. Maximum hopper population per panicle (10.75) was recorded in 5th treatment (2 kg N) followed by 8.45 hoppers per panicle in control which were at par. No significant differences in hopper populations were observed between 3rd (7.59 hopper per panicle) and 4th treatments (7.05 hoppers/panicle).

Hopper population was again maximum (20.06 hoppers/panicle) in 5th treatment where only 2 kg N was applied as recorded on 7.4.2001(3rd observation) which was significantly different from other treatments followed by control (13.60 hoppers/panicle), 3rd treatment (11.91 hoppers/panicle) and 6th treatment (10.65 hoppers/panicle) which were at par. Lowest hopper population (7.75 hoppers/ panicle) was found in 2nd treatment followed by 8.93 hoppers per panicle in 4th treatment where only Cu, Zn, B and S were applied and 9.90 hoppers per panicle in 1st treatment which were at par but significantly different form the control. Hopper population as recorded on 29.5.2001 (4th observation) showed downfall from previous observations. Minimum hopper population per panicle (2.82) was recorded in 2nd treatment, which was significantly different from other treatments. Hopper populations per panicle were 4.73, 4.79, 5.25 and 5.25 in 1st, 6th, 4th and control respectively which were at par. Maximum hopper population per panicle (8.59) was observed in 5th treatment which was significantly different from other treatments followed by 6.45 hoppers per panicle in 3rd treatment where 500 g NPK along with Cu, Zn and B were applied, which was at par with 4th treatment as well as control.

Effect on fruit set

Fruit set per 100 panicles as observed at pea size on 6.4.20012001 Table 2 was highest (189.75) in 2nd treatment followed by 168 fruits per 100 panicles in

Table 1 : Effect of fertilizers and micronutrients on hopper population.

	Treatments	Hopper population /panicle			
		1st Observation	2nd Observation	3rd Observation	4th Observation
1.	1.0 kg N + 0.5 kg P_2O_5 + 0.75 kg K_2O	7.12^{ad}	6.10^{ab}	9.90^{acd}	4.73^{a}
2.	1.5 kg N + 1.0 kg P_2O_5 + 1.0 kg K_2O + 250 g Cu + 200 g Zn + 200 g B + 250 g S	5.53^{a}	4.74^{b}	7.75^{a}	2.82^{b}
3.	0.5 kg N + 0.5 kg P_2O_5 + 0.5 kg K_2O + 250 g Cu + 200 g Zn + 200 g B	8.52^{bde}	7.59^{ad}	11.91^{bd}	6.45^{c}
4.	250 g Cu + 200 g Zn + 200 g B + 250 g S	7.91^{bde}	7.05^{ad}	8.93^{ac}	5.25^{ac}
5.	2.0 kg N only	11.85^{c}	10.75^{c}	20.06^{e}	8.59^{d}
6.	Biozyme (micronutrients)	7.50^{ae}	6.27^{ab}	10.65^{bc}	4.79^{a}
7.	Control	9.69^{ce}	8.45^{d}	13.60^{b}	5.25^{ac}
	CD (P=0.05)	2.28	1.92	2.24	1.22
	CV	18.51	17.81	12.79	15.29

Means followed by same latter are not significantly different

1st treatment which were at par, but significantly different from the control (Table 2) No significant differences were observed in fruit sets per 100 panicles among 4th treatment (123.75), 5th treatment (117.25), 6th treatment (122.25) and control (116). There were 136.75 fruits per 100 panicle recorded in 3rd treatment, which was at par with the 1st treatment and control. Fruit set as recorded at marble size on 24.5.2001 was maximum (139.25 fruits per 100 panicles) in 2nd treatment, which was significantly different from other treatments. Fruits sets per 100 panicles were 126.75, 121.75, 115.50 and 112.00 in 3rd, 1st, 4th and 6th treatments which were at par with each other but significantly different from the control. Minimum fruit set per 100 panicles (105.25) was recorded in control followed by 106.25 fruits in 5th treatment where only 2 kg N was used which were at par. However, fruit set in recommended dosage (121.75 fruits per 100 panicles) and 3rd treatment (126.75) was significantly different from the control.

Table 2: Effect of fertilizers and micronutrients on fruit set, fruits harvested and fruit weight.

	Treatments	Fruit set /100 panicles		Fruits harvested /100 panicles	Fruit weight/100 panicles
		At pea stage	At marble stage		
1.	1.0 kg N + 0.5 kg P_2O_5 + 0.75 kg K_2O	168.00^{ac}	121.75^{a}	105.00^{a}	19.00^{a}
2.	1.5 kg N + 1.0 kg P_2O_5 + 1.0 kg K_2O + 250 g Cu + 200 g Zn + 200 g B + 250 g S	189.75^{c}	139.25^{b}	110.25^{b}	21.00^{b}
3.	0.5 kg N + 0.5 kg P_2O_5 + 0.5 kg K_2O + 250 g Cu + 200 g Zn + 200 g B	136.75^{ab}	126.75^{a}	107.50^{a}	17.57^{ade}
4.	250 g Cu + 200 g Zn + 200 g B + 250 g S	123.75^{b}	115.50^{ac}	105.75^{ab}	18.40^{a}
5.	2.0 kg N only	117.25^{b}	106.25^{c}	100.25^{c}	16.30^{ce}
6.	Biozyme (micronutrients)	122.25^{b}	112.00^{ac}	100.75^{c}	17.92^{ad}
7.	Control	116.00^{b}	105.25^{c}	100.25^{c}	16.52^{cd}
	CD (P=0.05)	36.27	11.43	3.98	1.58
	CV	17.55	6.51	2.57	5.90

Means followed by same latter are not significantly different

Effect on fruit harvest

Fruits harvested per 100 panicles recorded on 25.6.2001 was maximum (110.25) in 2nd treatment followed by 107.50 fruits per 100 panicles in 3rd treatment which were at par, but significantly different from the control. Fruits harvested were 105.75 and 105 fruits per 100 panicles in 4th and 1st treatment (recommended dose) which were at par but significantly different from the control. No significant differences were observed in fruits sets per 100 panicle among 5th treatment (100.25), 6th treatment (100.75) and control (100.25). Fruit weight was maximum (21 kg per 100 panicles in 2nd treatment, which was significantly different from other treatments. Fruits weight per 100 panicles were 19.00 and 18.40 kg in 1st and 4th treatments which were at par, but significantly different from control (16.52 kg per 100 panicles). No significant differences existed in fruit weights per 100 panicles in 3rd (17.57 kg), 6th (17.92 kg) treatments and control. Minimum fruit weight (16.30 kg per 100 panicles) was obtained in 5th treatment where only 2 kg N was applied which was at par with control.

From the above results, it is clear that the 1st treatment with 1.5 kg N, 1 kg P_2O_5 and 1 kg along with Cu, Zn, B and S were applied was most effective in controlling hoppers as well as fruit set and fruit harvest followed by recommended doses whereas the treatment where only 2 kg N was applied was least effective as maximum hopper population, lowest fruit number and fruit weight was maintained here. In most cases, significant differences in hopper population between recommended dose and control were observed. However, in rest of the treatments, in most observations, the fruit set, fruits harvested and fruit weight was at par with each other or with control. Syamal and Mishra (17) reported that double NPK application resulted greatest flower number, fruits set, fruit retention and fruit size etc. Fruit set was increased by zinc application (Daulta *et al.,* 2) and fruit retention was increased where boron was applied (Singh and Dhillon, 16). However, dependence of a nutrient element to assess the nutrient status or yield of the tree would be misleading as, the yield was the

interdependent and cumulative effect of all the nutrients used. Nachiappan and Baskaran (6) reported that resistance in certain varieties could also be influenced by the presence of higher potassium in the inflorescence of mango. Havelka and Bartova (5) reported that gall midge Aphidolates aphidimyza when treated with chemicals based on zinc, copper, and aluminium, higher mortality occurred. Singh (15) reported that phosphorus fertilization has been known to reduce the incidence of jassid (*Amrasca kerri*) and six defoliators in cowpea and H. armigera in chickpea.

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