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PRELIMINARY INVESTIGATIONS ON THE EFFECT OF FOLIAR SPRAY OF CHEMICALS ON FLOWERING, FRUIT SETTING AND RETENTION OF FRUITS OF MANGO CV. MALLIKA

D.P. Saha, K.K. Jha, S. Sengupta, S. Misra, H.C. Lal* and K. Prasad**
Department of Horticulture, Ranchi College of Agriculture, Kanke, Ranchi - 600 051, India
**Department of Plant Breeding and Genetics, Ranchi College of Agriculture, Ranchi
*Department of Plant pathology, Ranchi College of Agriculture, Ranchi

Abstract: The present investigation was conducted during 2014-2015 for one season on 'Mallika' mango under high density planting system (4m x 4m) at Nursery-Cum- Orchard of the Department of Horticulture, RAC, Kanke, Ranchi on 08 years old plants. Foliar spray of 1 and 1.5 % potassium di-hydrogen phosphate (KH_2PO_4) , 1 and 1.5 % di-potassium hydrogen phosphate (K_2HPO_4) and the combinations of these four treatments with 1% potassium nitrate (KNO_3) and 1% thiourea (CH_4N_2S) including two controls (one with water spray and another without any spray) were considered. Each treatment replicated thrice and one plant was considered as a unit of treatment. Amongst the different chemicals used, treatment KH_2PO_4 1% + KNO_3 1% was most effective regarding the Panicle emergence and it was noted 5.67 days earlier in comparison to control whereas the flowering was recorded 4.66 days earlier with the treatment KH_2PO_4 1.5 % + KNO_3 1% than control. The highest percent (74.01) of flowering shoot was observed with K_2HPO_4 1.5 % and KNO_3 1% whereas the highest number (306.33) of hermaphrodite flowers, lowest sex ratio (2.21) and the maximum number (28.00) of fruits set (at marble stage) were recorded under the treatment KH_2PO_4 1% + thiourea 1%. The highest number (3.13) of fruits retained per panicle (at harvest) and fruit yield (41.23 kg/plant) was found in trees treated with K_2HPO_4 1.5 % + KNO_3 1% spray.
Keywords: Mango, potassium, thiourea, flowering, fruiting.

INTRODUCTION

Mallika, is a major late variety grown commercially with a view to export due to its acid blending sweetness and firm pulp. Its nature of shy bearing and profuse bearing in alternate year is the problem whereas the main objective of a mango grower is to harvest maximum quantity of marketable fruits at the lowest cost every year. The production of flowers may be governed by enhancing the flowering shoots percent and the production may be increased by enhancing the percent of fruit-set and its retention up to the harvest. Fruit set response is related to the activity of plant hormones and probably with nutrition in a more indirect way (Mengel et al., 2001).Several workers have also suggested that foliar feeding of nutrients directly to the site of metabolism as a substitute for or supplement to soil application

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considerably enhanced fruit yield and quality attributes (Samra et al., 1977; Singh et al, 1994). It has also been recognized that mango leaves absorb most of the nutrients within 24 - 72 hours after spray and, thereafter, depletion of leaf nutrient content is seen owing to translocation of N, P, K to actively developing organs within the plant system (Singh, 2002).

In the light of above, the present investigation was undertaken to study the effect of foliar spray of chemicals on flowering and fruiting characters of trees of mango cv. Mallika.

MATERIAL AND METHODS

The present investigation was conducted during 2014-2015 for one season on mango under high density planting system (4m x 4m) at Nursery-Cum- Orchard of the Department of Horticulture, Ranchi Agriculture College, Kanke, Ranchi on 08 years old, healthy and normal mango orchard of cv. Mallika. The experiment was laid out in a randomized block design with fourteen treatments namely foliar spray of 1 and 1.5 %potassium di-hydrogen phosphate (KH_2PO_4, 00: 52: 34), 1 and 1.5 % di-potassium hydrogen phosphate (K_2HPO_4, 00: 40: 54) sprayed on 15th October 2014 (at fruit bud differentiation stage) and the combinations of these four treatments individually with 1% potassium nitrate (KNO_3,13 : 00 : 46) and 1% thiourea (CH_4N_2S) were sprayed on 15th January2015 (during bud break stage) including two controls (one with water spray and another without any spray). Each treatment replicated thrice and one plant was considered as a unit of treatment. Forty two plants of mango cv. Mallika were selected for the study.

Observations were made on duration of panicle emergence, duration of flowering, percentage of flowering shoot, length of panicle (cm), number of staminate flowers per panicle, number of hermaphrodite flowers per panicle, sex-ratio (male/hermaphrodite) per panicle, number of fruit-set per panicle (at marble stage), number of fruits retained per panicle (at harvest) and yield per plant (kg). The data were subjected to ANOVA wherever applicable and their means were presented.

RESULTS AND DISCUSSIONS

The data presented in Table 1 revealed that there was significant difference of chemicals sprays on duration of panicle emergence in mango KH_2PO_4 1% + KNO_3 1% spray resulted in earliest emergence of panicle (11.33 days) followed by KH_2PO_4 1% + KNO_3 1% spray (12.67 days) and K_2HPO_4 1.5% spray (12.67 days) whereas the longest duration of panicle emergence (17.33 days) was observed with control (water spray).The results are in conformity with Kumar and Reddy(2008) and Baiea et al (2015).The earlier panicle

appearance in KNO_3 treated plants might be due to the fact that KNO_3 acts as a bud dormancy breaking agent (Tongumpai et al., 1989).

The treatment KH_2PO_4 1.5% + KNO_3 1% flowered earlier (9.67 days) followed by KH_2PO_4 1% + KNO_3 1% (10.00 days) and thus reduced the duration of flowering period in comparison to 14.67 days in control (water spray). Suresh et al. (2003) reported advancement of flowering in cv. Baneshan with KH_2PO_4+ KNO_3 sprays. Earlier flowering in mango promoted by foliar spray of KNO3, which promotes ethylene biosynthesis has also been reported by Mosqueda-Vazquez and Avila-Resendiz (1985).

K_2HPO_4 1.5 % + KNO_3 1% spray resulted in highest (74.01) percentage of flowering shoots followed by K_2HPO_4 1 % + KNO_3 1% spray (73.51) and KH_2PO_4 1.5 % + KNO_3 1% spray (70.83). Least percentage (54.38) of flowering was observed in control (water spray). This findings are in conformity with Garcia et al (2008), Sudha et al (2012), Sarker and Rahim (2013), Afiqah et al (2014) and several others in mango fruit. This result also agrees with that reported by other fruits, in which an application of P increased flowering (Agusti, 2003), and increase metabolism in these buds, P promotes the absorption of Mg, an element that is fundamental in the floral formation and promotes the synthesis of nucleic acids (Feucht, 1982). According to the statement Marschner (2002), the number of flowers formed is reduced in the case of a deficiency of P. Furthermore, the fraction of K in the KH_2PO_4 could stimulate photosynthesis and transport of photo assimilates, among others, which is very important for the formation of flowers (Swietlik, 2003). This may also be due to the applications of nitrogenous compounds containing NO_3^- or $NH\ 4^+$ increased levels of arginine, compound which can promote flowering as reported by George et al. (2003).

Treatment	Duration of panicle emergence	Duration of flowering	Flowering shoot (%) *	No. of staminate flowers / panicle	No. of hermaphrodite flowers / panicle	Sex ratio	No. of fruits set / panicle	No. of fruits retained / panicle	No. of fruits / plant	Yield / plant (kg)
T_1-KH_2PO_4 (1%)	14.00	13.00	62.14 (45.47)	659.33	215.67	3.06	17.33	2.51	74.30	35.54
T_2-KH_2PO_4 (1.5%)	13.33	13.33	61.97 (41.97)	643.33	210.00	3.07	18.33	2.54	75.13	36.19
T_3-K_2HPO_4 (1%)	12.67	13.00	63.55 (43.55)	663.33	219.33	3.05	18.67	2.77	78.14	38.43
T_4-K_2HPO_4 (1.5%)	13.33	12.67	64.34 (44.34)	638.67	233.00	2.76	21.67	2.83	81.88	40.04
T_5-KH_2PO_4 (1%) + KNO_3 (1%)	11.33	10.00	70.17 (50.17)	793.33	278.33	2.86	25.67	3.12	83.39	41.28
T_6-KH_2PO_4 (1.5%) + KNO_3 (1%)	12.67	9.67	70.83 (50.83)	770.33	277.33	2.78	24.33	3.06	82.25	40.41
T_7-K_2HPO_4 (1%) + KNO_3 (1%)	13.67	10.33	73.51 (53.51)	827.33	297.00	2.81	26.67	3.02	80.48	39.97
T_8-K_2HPO4 (1.5%) + KNO_3 (1%)	14.33	10.67	74.01 (54.01)	802.67	303.67	2.66	27.67	3.13	84.60	41.23
T_9-KH_2PO_4 (1%) + Thiourea (1%)	16.33	11.00	64.04 (44.04)	679.00	306.33	2.22	28.00	2.84	81.81	40.03
T_{10}-KH_2PO_4 (1.5%) +Thiourea (1%)	16.67	11.67	63.59 (43.59)	638.00	287.00	2.24	23.67	2.83	81.28	37.82
T_{11}-K_2HPO_4 1% +Thiourea (1%)	16.00	12.33	65.46 (45.46)	731.33	270.00	2.71	23.33	2.56	77.14	36.93
T_{12}-K_2HPO_4 (1.5% +Thiourea (1%)	16.33	12.00	67.05 (47.05)	701.33	258.67	2.72	22.33	2.54	76.97	35.67
T_{13}-Control (water Spray)	17.33	14.67	54.38 (39.71)	597.67	196.67	3.05	13.67	2.45	70.57	28.95
T_{14}-Control (No Spray)	17.00	14.33	55.33 (40.33)	612.00	203.33	3.01	14.33	2.43	69.92	28.64
SE m(±)	**0.6073**	**0.59**	**2.07**	**18.21**	**11.05**	**0.14**	**0.80**	**0.11**	**2.08**	**1.79**
CD at 5%	**1.7656**	**1.71**	**6.01**	**52.93**	**32.12**	**0.41**	**2.33**	**0.32**	**6.03**	**5.20**

*Degree in parenthesis

Table1. Effect of foliar spray of chemicals on flowering and fruiting of mango cv. Mallika

The panicle length was least (23.00 cm) with control (no spray)) and highest in KH_2PO_4 1% + KNO_3 1% spray followed by KH_2PO_4 1.5 % + $KNO_3$1% (29.00 cm) and K_2HPO_4 1.5 % + $KNO_3$1 % (29.00 cm) results are in line with Garcia et al (2008), Sudha et al (2012) and Sarkerand Rahim (2013) which might be due to the availability of more nutrients to panicles Kumar and Reddy (2008).

In the present investigation marked variation in the sexuality of flowers has been observed as a result of chemicals application. The number of staminate flowers per panicle was recorded highest (827.33) in K_2HPO_4 1% + $KNO_3$1 % followed by K_2HPO_4 1.5 % + $KNO_3$1 % (802.67) but minimum (597.67) in control (water spray). Chemical sprays also influenced the percentage of hermaphrodite flowers. Among the chemical sprays KH_2PO_4 1% + thiourea 1%recorded highest number (306.33) of hermaphrodite flowers per panicle followed byK_2HPO_4 1 % + KNO_3 1% spray (303.67) whereas the minimum (196.67) hermaphrodite flowers per panicle was recorded under control (water spray). Similar results observed by Barros et al. (1998) and Oosthyse (1996) in mango which might be due to the availability of more nutrients to panicles.

The sex-ratio was least (2.22) in the panicles of plants treated with KH_2 PO_4-1% + thiourea1% followed by KH_2 PO_4-1.5 % + Thiourea1% (2.24) and the highest (3.07) sex-ratio was recorded with KH_2 PO_4 (1.5%) followed by3.06 with KH_2 PO_4 (1.5 %) and 3.05 with control (water spray). Sarker and Rahim (2013) and Baiea et al (2015) also confirm the findings.

The highest (28.00) fruit setting per panicle was with KH_2 PO_4-1% + Thiourea1% closely followed by K_2H PO_4-1.5% + KNO_3 -1% (27.67) but the retention of fruit was maximum with K_2H PO_4-1.5% + KNO_3 -1% closely followed by K_2H PO_4-1% + KNO_3 -1%. (26.67). It means the contribution of thiourea along with mono-potassium phosphate was excellent in fruit setting but in fruit retention potassium nitrate (KNO_3) contributed excellentlyalong with di-potassium phosphate. It means the fruit dropping was lesser with KNO3 treated trees rather than thiourea treated trees. Results are in conformity with those of Srihari and Rao (1998), Garcia et al. (2008), Sudha et al (2012), Sarker and Rahim (2013) and Oosthuyse (2015). This result fully confirms the assertions of Agusti (2003) that the availability of mineral elements becomes critical at the time of flowering and setting and demand must be properly satisfied, as in the case with KH_2PO_4 - 0.5%.

Number of fruits per tree was maximum (84.60) over all with the chemical combinations of K_2H PO_4 (1.5%) with KNO_3 (1%) followed by KH_2PO_4 1% + KNO_3 1%

(83.39) and KH_2PO_4 1.5% + KNO_3 1% (82.25) whereas the control (no spray) reflected least (69.92).Suresh et al. (2003) reported increased fruits per tree in cv. Baneshan with KH_2PO_4 and KNO_3 sprays.Yield of Mallika mango was highest (41.23kg/plant) with the treatment of $K_2HPO_4$1.5% + $KNO_3$1% but all the combinations of KNO_3 with both the dilutions of KH_2PO_4 and K_2HPO_4 performed welland were statistically at par in their effects regarding both number of fruits and yield per plant and results are in line in mango fruits with those of Garcia et al. (2008), Sudha et al (2012), Sarker and Rahim (2013) and Oosthuyse (2015). Early flowering, fruiting and better retention of fruits would have facilitated the better utilization of nutritional resources within the tree resulting in maximum yields (Kumar and Reddy, 2008). Similar results were also reported in mango by Singh and Rajput (1990), MC Kenzie (1994) and Rojas (1996).

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