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Yield and yield attributing characters influenced by foliar spray of micronutrients and banana pseudostem sap at different pH levels of on mango cv. Kesar

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Abstract

The present experiment was conducted during 2015-16 and 2016-17 at RHRS, ACHF, NAU, Navsari, (Gujarat). The experiment was laid out in Randomized Block Design with Factorial Concept comprising two factors viz., different pH levels of foliar spray solution (4.5, 5.5 pH and best available water) and banana pseudostem sap (5%), novel organic liquid fertilizer (1 and 2%), mixture Grade IV (1%), boric acid (0.2%). The treatments were replicated thrice. The individual effects of foliar applications at induction of flowering and full bloom stage and their interactions on yield and yield attributing characters of mango cv. Kesar were recorded. The results revealed that the foliar spray solution at pH 4.5 level and foliar application of 2% novel organic liquid fertilizer gave maximum yield viz., number of fruits/panicle, numbers of fruits/tree and fruit yield (kg/tree and t/ha) and yield attributing characters like, fruit weight (g), fruit length (cm), fruit breadth (cm), fruit volume (cm³), specific gravity (g/cm³), firmness of fruit (kg/cm²), pulp: stone ratio and minimum peel percentage.

Interaction of different pH levels with banana pseudostem sap and micronutrients was found significant in case of number of fruits per panicle, fruit yield kg/tree and fruit yield t/ha of mango during investigation, which were the maximum when mango cv. Kesar tree treated at induction of flowering and full bloom stage with 2% novel organic liquid fertilizer at 4.5 pH level.

Keywords: pH level, banana pseudostem sap, novel organic liquid fertilizer

Introduction

Flowering in mango is preceded by the differentiation of the flower bud in the shoots. The period of differentiation is reported to be October – December in Gujarat conditions, depending upon the local climatic conditions. In mango, heavy fruit drop is an important factor contributing to low fruit yield and sometimes only 0.1% of fruits reached up to maturity. The maintenance of fruit quality is critical while, employing any new technology for increasing production and shelf life. Thus, fruit set in mango is crucial event which greatly influence the ultimate fruit yield. Foliar absorption is pH dependent. This is attributed to the effect on the cuticle of complex electrostatic repulsion and attraction phenomena, which are regulated by pH. Micronutrients play an active role in the plant metabolism process starting from cell wall development to respiration, photosynthesis, chlorophyll formation, enzymatic activity, hormone synthesis, nitrogen fixation and reduction. Apart from direct use of banana pseudostem sap as liquid fertilizer, an enrichment process was developed (patented) for preparing Novel Organic Liquid Fertilizer (NOLF) suitable for foliar and soil application by Navsari Agricultural University, Navsari. Novel organic liquid fertilizer is good source of plant nutrient along with growth promoting substances like cytokine, GA₃, etc.

Material and Methods

The present was conducted during 2015-16 and 2016-17 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, (Gujarat). The experiment was laid out in Randomized Block Design with Factorial Concept comprising two factors viz., different pH levels of foliar spray solution (4.5, 5.5 pH and best available water) and banana pseudostem sap (5%), novel organic liquid fertilizer (1 and 2%), mixture Grade IV (1%), boric acid (0.2%). The treatments were replicated thrice. The individual effects of foliar applications at induction of flowering and full bloom stage of

different pH levels of spray solutions and banana pseudostem sap and micronutrients treatment as well as their interactions on yield and yield attributing characters of mango cv. Kesar were recorded.

Result and Discussion

Effect of pH levels of spray solution

The data presented in Table 1 clearly revealed that the significantly maximum yield *viz.*, number of fruits/panicle, numbers of fruits/tree and fruit yield (kg/tree and t/ha) were obtained when plant treated with pH 4.5 level spray solution compared to other treatments. The most outstanding effect of pH 4.5 on yield was due to acidic pH increases the availability of Cations (H^+) in the spray solution and on the leaf surface. This creates a Cation diffusion gradient along which essential nutrients like Ca^+ , K^+ , Zn^+ , Mg^+ , Mn^+ , B^+ , Mo^+ can move across and through plant cell walls. Similar results were recorded by El-Otmani *et al.* (2002) [6] in citrus.

A perusal of data presented in Table 1 and 2 clearly revealed that, significantly the maximum fruit weight (g), fruit length (cm), fruit breadth (cm), fruit volume (cm^3), specific gravity (g/cm^3), firmness of fruit (kg/cm^2), pulp: stone ratio and minimum peel percentage of mango cv. Kesar were noted in pH 4.5 treatment (A_1). It might be due to pH affects the ionic status of some nutrients and also that of the cuticle because it contains some free (unesterified) carboxylic acids (Holloway, 1982) [7] and incorporates embedded waxes which are principally fatty acids (Baker, 1982) [4]. Similar results were reported by Jacyna *et al.* (2011) [8] in cherry.

Effect of micronutrients and banana pseudostem sap

A perusal of data presented in Table 1 clearly indicated that there were significant Increased in number of fruits/panicle, number of fruits/tree, fruit yield (kg/tree) and fruit yield (t/ha) due to foliar application of 2% novel organic liquid fertilizer (S_2) treatment. It might be due to the macro and micronutrients which present in novel organic liquid fertilizer. The nutrients N and K at higher rate exerted a significant positive influenced on number of fruits/tree and fruit yield. Usefulness of the nutrients to determine the influenced on yield attributing characters of mango is adequately stressed and the present study also corroborated with the findings of Anon. (2012) [2] in mango; Anon. (2011) [1] and Anon. (2014) [3] in banana; Deore *et al.* (2010) [5] in chilli.

The yield of mango cv. Kesar was significantly influenced by foliar spray of Grade- IV. In Grade – IV micronutrients Fe is available at 4% which is highly associated with chlorophyll synthesis which later on boosted up to the photosynthesis.

Promotion of starch formation followed by rapid transportation of carbohydrates in plants is activated by micronutrients like Cu, Fe, Mn, Zn and B which are well established. The most outstanding effect of 1% Grade – IV on yield was due to favorable effect on number of fruits/panicle, number of fruits/tree, fruit yield kg/tree and fruit yield t/ha.

The better yield parameters *i.e.* numbers of fruits per panicle, number of fruits per tree, fruit yield kg/tree and fruit yield tone per hector were also obtained from plant treated with 0.2% boric acid. It might be due to boron involved in translocation of starch to fruit resulted into better photosynthesis and accumulation of starch in fruits. The balance of auxin in plant also regulates the fruits drop or retention in plants, which ultimately increased the total number of fruits per tree. The role of boron was also reported in fruit setting, which ultimately increased the number of fruits per tree (Thompson and Batjer, 1950) [10].

The data presented in Table 1 and 2 clearly revealed that foliar application of novel organic liquid fertilizer 2% at induction of flowering and full bloom stage recorded maximum fruit weight (g), fruit length (cm), fruit breadth (cm), fruit volume (cm^3), specific gravity (g/cm^3), firmness of fruit (kg/cm^2), pulp: stone ratio and minimum peel percentage of mango cv. Kesar. Foliar application of micronutrients and banana pseudostem sap involved directly in various physiological processes and enzymatic activity. It might be due to higher carbohydrate accumulation in plant at early stages of growth as a resulted better nutrient supply, which causes an increased in fruit size and there by increased the fruit length, fruit volume, firmness of fruit, fruit breadth of mango. Similar results were reported by Anon. (2011) [1] and Anon. (2014) [3] in banana and Deore *et al.* (2010) [5] in chilli.

The foliar application of 1% Grade – IV micronutrients increased size of the fruit *i.e.*, fruit length, firmness of fruit and minimum peel percentage. This might be due to higher rate of micronutrients increased synthesis of starch food material which was reflected in increased size of fruit in terms of length and firmness of fruit and minimum peel percentage.

In the present investigation, foliar application of 0.2% boric acid treatment recorded the maximum physical characters. Boron increases the rate of sugar transport to active growing regions and also to developed fruits. Therefore, increasing fruit physical characters may be attributed to the improvement of fruit growth and uptake of B nutrients that accelerate metabolic processes. Similar findings were reported by Sankar *et al.* (2013) [9] and Tulsi Gurjar *et al.* (2015) [11] in mango.

Table 1: Effect of different pH levels, micronutrients and banana pseudostem sap on yield and yield attributing characters of mango cv. Kesar (mean of two years)

Treatments	No. of fruits/panicle	No of fruits/ tree	Fruit yield (kg/ tree)	Fruit yield (t/ha)	Fruit weight (g)	Fruit length (cm)
pH levels of spray solution						
A ₁ : pH 4.5	1.73	238.74	70.23	28.09	289.74	12.91
A ₂ : pH 5.5	1.50	228.67	61.22	24.49	262.57	11.48
A ₃ : Best available water	1.25	208.32	50.24	20.10	235.40	10.37
S.E.m. ±	0.03	4.21	1.57	0.63	4.99	0.24
C.D. at 5%	0.08	11.93	4.45	1.78	14.13	0.67
Micronutrient and banana pseudostem sap						
S ₁ : Banana pseudo stem sap 5%	1.25	212.77	54.42	21.77	250.74	10.50
S ₂ : Novel organic liquid fertilizer 1%	1.11	200.35	49.56	19.83	241.88	10.17
S ₃ : Novel organic liquid fertilizer 2%	1.98	249.81	74.04	29.62	290.52	13.00
S ₄ : Mixture Grade IV 1%	1.42	225.31	59.63	23.85	260.04	12.46
S ₅ : Boric acid 0.2%	1.73	237.98	65.17	26.07	269.66	11.79
S.E.m. ±	0.04	5.43	2.03	0.81	6.44	0.31

C.D. at 5%	0.11	15.40	5.74	2.30	18.25	0.87
Interaction effect (A×S)						
S.Em. ±	0.07	9.41	3.51	1.40	11.15	0.53
C.D. at 5%	0.19	NS	10.53	4.20	NS	NS
CV%	10.94	10.23	14.20	14.20	10.40	11.23

Table 2: Effect of different pH levels, micronutrients and banana pseudostem sap on yield and yield attributing characters of mango cv. Kesar (mean of two years)

Treatments	Fruit breadth (cm)	Fruit volume (cm ³)	Specific gravity (g/cm ³)	Fruit firmness (kg/cm ²)	Pulp: Stone ratio	Peel (%)
pH levels of spray solution						
A1: pH 4.5	14.71	274.79	1.05	3.98	6.25	11.23
A2: pH 5.5	13.85	254.40	1.03	3.68	4.97	14.34
A3: Best available water	13.01	233.95	1.01	3.37	3.72	17.24
S.Em. ±	0.28	5.08	0.001	0.08	0.10	0.26
C.D. at 5%	0.80	14.39	0.003	0.22	0.27	0.75
Micronutrient and banana pseudostem sap						
S1: Banana pseudo stem sap 5%	13.33	248.34	1.01	3.54	4.39	14.13
S2: Novel organic liquid fertilizer 1%	13.11	243.69	0.99	3.46	4.17	16.83
S3: Novel organic liquid fertilizer 2%	15.46	267.76	1.08	4.08	6.89	12.90
S4: Mixture Grade IV 1%	13.80	251.90	1.03	3.70	4.83	13.45
S5: Boric acid 0.2%	13.57	260.21	1.04	3.62	4.61	14.01
S.Em. ±	0.36	6.55	0.002	0.10	0.12	0.34
C.D. at 5%	1.03	NS	0.004	0.28	0.35	0.96
Interaction effect (A×S)						
S.Em. ±	0.63	11.35	0.003	0.17	0.21	0.59
C.D. at 5%	NS	NS	NS	NS	NS	NS
CV%	11.14	10.93	0.64	11.54	10.47	10.13

Table 3: Interaction between of different pH levels with micronutrients and banana pseudostem sap on fruit yield of mango cv. Kesar (mean of two years)

Treatment combinations	No. of fruits/ panicle	Fruit yield (kg/tree)	Fruit yield (t/ha)
A1S1	1.39	63.63	25.45
A1S2	1.20	58.92	23.57
A1S3	2.38	85.92	34.37
A1S4	1.66	68.69	27.47
A1S5	2.05	73.97	29.59
A2S1	1.26	54.87	21.95
A2S2	1.13	49.96	19.98
A2S3	2.01	75.43	30.17
A2S4	1.41	60.10	24.04
A2S5	1.72	65.73	26.29
A3S1	1.11	44.74	17.90
A3S2	1.01	39.81	15.92
A3S3	1.56	60.78	24.31
A3S4	1.18	50.10	20.04
A3S5	1.42	55.80	22.32
S.Em. ±	0.07	3.51	1.40
C.D. at 5%	0.19	10.53	4.20
CV%	10.94	14.20	14.20

Interaction effect

Data illustrated in Table 3 clearly indicated that the mango cv. Kesar plants treated with 2% novel organic liquid fertilizer at 4.5 pH level recorded significantly maximum number of fruits per panicle, fruit yield kg/tree and fruit yield t/ha.

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