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Research Article

EFFECT OF NITROGEN AND MICRONUTRIENTS ON GROWTH AND YIELD OF BER (*Ziziphus mauritiana* L.) *Cv.* GOLA UNDER MALWA PLATEAU OF MADHYA PRADESH

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Abstract- An experiment was conducted to evaluate the effect of nitrogen and micronutrients on growth and yield of ber (*Ziziphus mauritiana* L.) *cv.* Gola under malwa plateau of Madhya Pradesh at the *Instructional cum research fruit orchard*, Department of Fruit Science, College of Horticulture, Mandsaur during 2010-11 on well established six years old orchard of ber planted at 6.0 m X 6.0 m.. The experiment was laid out in Randomized Block Design (RBD) with three replications. The experiment comprised eleven treatments including control (T_1), Urea 1.5 %, (T_2), Urea 1.5% + $ZnSo_4$ 0.25% (T_3), Urea 1.5%+ $ZnSO_4$ 0.50% (T_4), urea 1.5% + $ZnSO_4$ 1.00 % (T_5), Urea 1.5% + $ZnSO_4$ 0.25% + Boron 0.25 % (T_6), urea 1.5% + $ZnSO_4$ 0.50% + Boron 0.50% (T_7), urea 1.5% + $ZnSO_4$ 1.00% + Boron 1.00 % (T_8), Urea 1.5% + $ZnSO_4$ 0.25% + Boron 0.25% + $MnSO_4$ 0.2 % (T_9), Urea 1.5% + $ZnSO_4$ 0.50% + Boron 0.50% + $MnSO_4$ 0.4 % (T_{10}) and Urea 1.5% + $ZnSO_4$ 1.00% + Boron 1.00% + $MnSO_4$ 0.6 % (T_{11}). The results revealed that the maximum shoot length (184.33 cm, 194.33 cm, 211.10 cm at 15, 30 and 45 days after spray respectively), maximum number of leaves per shoot (650, 670, 675 at 15, 30 and 45 days after spray respectively), maximum leaf area (33.13 cm^2, 34.87 cm^2 and 35.85 cm^2 at 15, 30 and 45 days after spray respectively), minimum days taken to 50% flowering (6.5 days) and maximum fruit retention (41.16) were observed T_{11} (receiving Urea 1.5% + $ZnSO_4$ 1.00% + Boron 1.00% + $MnSo_4$ 0.6%). However, the maximum shoot girth (7.21 cm, 7.72 cm and 8.22 cm respectively), highest per cent of fruit setting (5.156), highest yield (33.63 kg) per tree , highest yield per hectare (93.15q) were obtained under T_{10} (receiving Urea 1.5%+ $ZnSO_4$ 0.50% + Boron 0.50% + $MnSO_4$ 0.4%). The minimum values of observations were noted in control under the present studied.

Keywords- Ber, Gola, Micronutrients, $ZnSO_4$, $MnSO_4$, Urea and Boron.

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Introduction

Ber (*Ziziphus mauritiana* L.) is a subtropical fruits crop, one of the most common fruit crop grown under neglected soil type. It is member of Rhamnaceae family and origin of ber is said to be India to south –western Asia. It is a drought hardy and can grow under the most hazardous condition of soil water and climate and thus it has hightly recommended for the arid and desert area of India [9]. The cultivated area of ber increased due to better adoptability and higher return in arid, semiarid and irrigated areas.

The ber is highly paying and rich in food value, particularly ascorbic acid and protein. It is nutritious and is a rich source of vitamin–C, thiamin and riboflavin. It is popularly called as poor means apple due to its high nutritional and medicinal value. Ber fruit is more nutritive than apple because for its higher protein (0.8g), beta carotene (70 IU) and vitamin c (50-100mg) contents. Ber fruit pulp contain 12.8 to 13.6 % carbohydrate of which, 5.6 % are sucrose, 1.5% glucose, 2.1% fructose and 1.0 % starch.

To meet out the increasing demand of fruits the chance of bringing more area under fruit crops are very less due to heave population pressure and therefore only alternative left into increase the production and quality of the existing orchards. The production of poor quality fruits is a matter of common experience. It would therefore be worthwhile to improve the yield and quality of ber fruit with foliar feeding of nutrient. Moreover nutrient like nitrogen play a vital role in promising the plant vigour and productivity. The micronutrient like zinc sulphate, boron and manganese are not only essential but equally important like other major nutrients in spite of their requirement in quality. Vegetative growth increased with the foliar application of nitrogen ad earlier reported by [2] in ber and [10] in mandarin orange.

Zinc promotes synthesis of indole acetic acid through tryptophan which serves as a precursor for auxin synthesis and directly affected the growth parameters as well as yield parameters. In view of the above fact it become quite clear that foliar spray of macro and micronutrients are very important for not only increasing plant vigour, but also for enhance the yield.

Materials and Methods

The experiment was conduct during the year of 2010-11 in the *Instructional cum research fruit orchard*, Department of Fruit Science, College of Horticulture Mandsaur (M.P.) on well established six years old orchard of ber planted at 6.0 m X 6.0 m. The experiment was laid out in Randomized Block Design (RBD) with three replications. Ber cv. Gola was selected for this study and foliar spray was made by urea, commercial zinc sulphate monohydrate ($ZnSO_4$ 33%), micron bor (Boron 20%) and manganese sulphate ($MnSO_4$ 26%). The experiment comprised

eleven treatments including control (T_1), Urea 1.5 %, (T_2), Urea 1.5% + $ZnSO_4$ 0.25% (T_3), Urea 1.5%+ $ZnSO_4$ 0.50% (T_4), urea 1.5% + $ZnSO_4$ 1.00 % (T_5), Urea 1.5% + $ZnSO_4$ 0.25% + Boron 0.25 % (T_6), urea 1.5% + $ZnSO_4$ 0.50% + Boron 0.50% (T_7), urea 1.5% + $ZnSO_4$ 1.00% + Boron 1.00 % (T_8), Urea 1.5% + $ZnSO_4$ 0.25% + Boron 0.25% + $MnSO_4$ 0.2 % (T_9), Urea 1.5% + $ZnSO_4$ 0.50% + Boron 0.50% + $MnSO_4$ 0.4 % (T_{10}) and Urea 1.5% + $ZnSO_4$ 1.00% + Boron 1.00% + $MnSO_4$ 0.6 % (T_{11}).

Results and Discussion

The results obtained from the present investigation are summarized below:

Vegetative growth characteristics

The present results indicated from [Table-1] that foliar application of nitrogen and micronutrients were helpful in increasing vegetative growth in terms of shoot length, shoot girth, number of leaves per shoot and leaf area etc. The maximum shoot length was recorded under T_{11} (receiving Urea 1.5% + $ZnSO_4$ 1.00% + Boron 1.00% + $MnSO_4$ 0.6%) *viz.,* 184.33 cm, 194.33 cm, 211.10 cm at 15, 30 and 45 days after spray respectively, maximum shoot girth was recorded under T_{10} (receiving Urea 1.5%+ $ZnSO_4$ 0.50% + Boron 0.50% + $MnSO_4$ 0.4%) *viz.,* 7.21 cm, 7.72 cm and 8.22 cm respectively. T_{10} gave the best result as compared to T_{11} shows that T_{11} receive excess amount of chemicals from need. Increased stem girth observed under T_2, T_4, T_7 and T_{10} and were statically significant over control, maximum number of leaves per shoot was recorded under T_{11} (receiving Urea 1.5% + $ZnSO_4$ 1.00% + Boron 1.00% + $MnSO_4$ 0.6%) *viz.,* 650, 670, 675 at 15, 30 and 45 days after spray respectively. Increased numbers of leaves per shoot were recorded under T_2, T_5, T_8 and T_{11} and they were statistically significant over control. Maximum leaf area was observed under T_{11} (receiving Urea 1.5% + $ZnSO_4$ 1.00% + Boron 1.00% + $MnSO_4$ 0.6%) *viz.,* 33.13 cm^2, 34.87 cm^2 and 35.85 cm^2 at 15, 30 and 45 days after spray respectively. Increased leaf area recorded under treatments of T_2, T_5, T_8 and T_{11} and statically significant over control, T_{10} at par with T_{11} but T_{11} was not usual due to more expenditure than T_{10}, whereas the minimum shoot length was observed in control. Statistically it is significant over control. Similar trends were obtained by [2] in ber and [10] in mandarin orange and [4] in ber. The beneficial effect of nitrogen in increasing the growth in terms of height, plant spread and stem girth might be due to the fact that absorbed nitrogen combined with carbohydrates synthesis, leads to the formation of nitrogenous compounds such as protein, nucleic acid, nucleotides, enzymes and co-enzymes to build up new tissues.

Foliar application of zinc sulphate also increased the vegetative growth of trees. It is in conformity to the findings of [8] in Kinnow. It might be due to the fact that sprayed zinc sulphate activated the normal nitrate reduction phenomenon for the synthesis of protein which is reported to protect chlorophyll destruction. Zinc also promotes synthesis of indole acetic acid through tryptophan which serves as a precursor for auxin synthesis and directly affects the growth parameters.

Table-1 *Effect of nitrogen and micronutrients on vegetative growth of ber cv.Gola.*

Treatment	Shoot length (cm)				Shoot girth (cm)				Number of leaves per shoot				Leaf area(cm2)			
	at the time of spray	after 15 days	after 30 days	after 45 days	at the time of spray	after 15 days	after 30 days	after 45 days	at the time of spray	after 15 days	after 30 days	after 45 days	after 15 days	after 30 days	after 45 days	after 15 days
T_1	113.06	120.16	130.00	141.33	5.44	6.32	6.82	7.32	318	350	401	455	20.13	22.77	24.77	26.77
T_2	113.00	152.36	158.00	168.19	5.56	6.35	6.87	7.37	310	444	450	460	19.94	24.53	26.59	28.70
T_3	112.00	160.29	169.13	173.33	5.54	6.74	7.22	7.73	322	460	490	499	20.00	25.43	27.46	29.24
T_4	114.10	168.67	181.09	189.11	5.59	6.77	7.32	7.76	324	499	526	530	20.16	27.06	29.21	31.11
T_5	113.00	170.33	183.00	191.18	5.51	6.76	7.26	7.74	325	508	534	540	20.10	28.16	30.02	31.69
T_6	112.00	174.39	184.66	193.43	5.57	6.83	7.42	7.85	321	546	575	580	20.11	29.42	31.60	32.00
T_7	115.03	177.12	186.69	196.69	5.51	6.91	7.45	7.93	324	585	590	599	20.06	30.51	32.25	35.03
T_8	114.16	178.18	188.36	198.08	5.48	6.91	7.45	8.07	326	590	593	605	20.23	30.55	32.34	35.19
T_9	114.93	180.00	190.35	201.29	5.45	7.11	7.61	8..04	322	600	610	642	20.14	31.92	33.60	35.69
T_{10}	113.06	183.00	193.00	209.49	5.50	7.21	7.7	8.22	311	640	665	670	20.03	33.04	34.82	35.79
T_{11}	111.66	184.33	194.33	211.10	5.44	7.21	7.72	8.22	316	650	670	675	20.00	33.13	34.87	35.85
S.Em	1.252	0.382	0.602	1.532	0.215	0.174	0.173	0.233	5.502	2.806	2.790	4.159	0.962	0.468	0.445	0.532
C.D. at 5%	NS	1.128	1.77	4.52	NS	0.513	0.511	0.688	NS	8.280	8.232	12.27	NS	1.382	1.315	1.569

Flowering, fruit setting and fruit retention characteristics

The results shows [Table-2] that the minimum days (6.5 days) taken to 50% flowering was observed in T_{11}. Decreased number of days taken to 50% flowering was observed in T_2 (16 days), T_5 (12.5 days), T_8 (9.5 days), and T_{11} (6.5 days). From above mention, it is clear that T_{11} (6.5 days) taken very less time and area statically significant over control whereas the maximum (17 days) days taken to 50% flowering was observed under control. T_{10} at par with T_{11} but T_{11} was not usual due to more expenditure than T_{10}. The highest (5.156) per cent of fruit setting was noted under T_{10} whereas the minimum (5.110) per cent of fruit setting was noted in control but statistically did not significant over control. It is in conformity with the findings of [6] and [7]. Increased number of fruit retention was revealed under T_2 (17%), T_5 (28%), T_8 (36.23%), and T_{11} (41.16%) and they were statically significant over control. T_{10} at par with T_{11} but T_{11} was not usual due to more expenditure than T_{10}. Similar results obtained by [4].

Yield

It is evident from [Table-2] that the fruit yield increased by foliar application of urea 1.5% alone and conjunction with different micronutrients..

Table-2 *Effect of nitrogen and micronutrients on flowering, fruit setting, fruit retention and yield of ber cv. Gola.*

Treatment	Days of taken to 50% flowering	Fruit setting percent	Fruit retention percent	Yield per tree (kg)	Yield per hectare (q)
T_1	17.0	5.110	10.00	22.65	62.74
T_2	16.0	5.120	17.00	24.24	67.14
T_3	15.0	5.130	18.40	27.02	74.84
T_4	14.0	5.133	27.73	27.84	77.11
T_5	12.5	5.140	28.00	27.25	75.48
T_6	12.0	5.143	28.46	28.95	80.19
T_7	11.0	5.146	35.69	29.97	83.01
T_8	9.5	5.150	36.23	29.26	81.99
T_9	9.0	5.153	36.50	32.69	90.55
T_{10}	8.0	5.156	40.46	33.63	93.15
T_{11}	6.5	5.143	41.16	33.05	91.54
S.Em	**0.522**	**0.009**	**0.343**	**0.016**	**0.371**
C.D.at 5%	**1.540**	**NS**	**1.013**	**0.047**	**1.096**

Average fruit yield per plant significantly increased under T_2 (24.24 kg), T_4 (27.84 kg), T_7 (29.97 kg) and T_{10} (33.63 kg) as compare to control (22.65 kg). Maximum yield (33.63 kg) per tree was recorded under T_{10}. T_{10} gave the best result as compared to T_{11} shows that T_{11} receive excess amount of chemicals from need. Similar results obtained by [2, 12, 11]

Yield per hectare significantly increase under treatment T_2 (67.14 q), T_4 (77.11 q), T_7 (83.01 q) and T_{10} (93.15 q) as compare to control (62.74 q). Maximum yield (93.15q) per hectare was obtained under T_{10} (receiving Urea 1.5%+ $ZnSO_4$ 0.50% + Boron 0.50% + $MnSO_4$ 0.4%). T_{10} gave the best result as compared to T_{11} shows that T_{11} receive excess amount of chemicals from need. Similar results obtained by [7, 1, 3] and [10] in mandarin orange. Since, nitrogen is an important constituent of protoplasm and is helpful in chlorophyll synthesis, the increased photosynthetic activity in the leaves and consequently the increase in yield as a result of nitrogen application seems to be rational. The increases in fruit weight by application of nitrogen and zinc sulphate were earlier reported by [5] in ber and [10] in mandarin orange. It might be due to the fact that nitrogen and zinc application increased the photosynthetic activity of the plant which is responsible for better fruit weight. Being a constituent of amino acid and chlorophyll, nitrogen and zinc increase the production of metabolites and consequently the fruit weight.

Conclusion

It is concluded that T_{10} (receiving Urea 1.5%+ $ZnSO_4$ 0.50% + Boron 0.50% + $MnSO_4$ 0.4%) superior over all treatments in terms of growth and yield attributes under the present studied.

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