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Effect of different organo-mineral fertilizers on growth, yield and quality of Perlette grape

II. Effect on yield and quality

by

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Einfluß verschiedener organisch-mineralischer Dünger auf Wachstum, Ertrag und Qualität bei der Rebensorte Perlette

II. Beeinflussung von Ertrag und Qualität

Zusammenfassung. — Organisch-mineralische Düngergemische unterschiedlicher Zusammensetzung wirkten sich folgendermaßen auf den Ertrag und die Traubenqualität der Rebensorte Perlette aus:

Im Versuchsjahr 1973—74 wurde durch Düngung mit T_{15} (0,5 kg Knochenmehl + 0,5 kg Zedrach-Preßkuchen + 0,5 kg Blutmehl + 0,990 kg Kalkammonsalpeter + 0,456 kg Superphosphat + 0,813 kg Chlorkalium) die höchste Anzahl von Trauben je Rebe erzielt; an zweiter Stelle folgte der Dünger T_{13} (0,5 kg Knochenmehl + 0,5 kg Blutmehl + 1,22 kg Kalkammonsalpeter + 0,487 kg Superphosphat + 0,825 kg Chlorkalium). 1973—74 war die Düngerwirkung umgekehrt. In beiden Jahren wurden unter dem Einfluß dieser zwei Düngervarianten auch die längsten Trauben mit dem größten Durchmesser gebildet. Bei Anwendung von T_{15} wurde auch das höchste Durchschnittsgewicht und -volumen der Trauben gemessen; nur wenig darunter lagen T_{13} und T_{12} (0,5 kg Knochenmehl + 0,5 kg Zedrach-Preßkuchen + 1,014 kg Kalkammonsalpeter + 0,500 kg Superphosphat + 0,822 kg Chlorkalium). Infolgedessen war der Höchstertrag bei T_{15}, gefolgt von T_{13}, zu verzeichnen. Der höchste Gehalt an löslicher Trockensubstanz wurde bei T_{15}, der höchste Säuregrad bei T_1 (1,22 kg Kalkammonsalpeter + 0,782 kg Superphosphat + 0,833 kg Chlorkalium) festgestellt. Die höchsten Konzentrationen des Gesamtzuckers und der reduzierenden Zucker wurden bei T_{15} beobachtet; die höchste Konzentration der nichtreduzierenden Zucker erbrachte dagegen T_{16} (8 kg Stallmist + 0,5 kg Knochenmehl + 0,5 kg Zedrach-Preßkuchen + 0,5 kg Blutmehl + 0,629 kg Kalkammonsalpeter + 0,640 kg Chlorkalium).

Introduction

In recent years grape growing has brought greater dividends per unit area than any other type of farming in India. As it has been amply demonstrated in a previous paper (Lavania and Singh 1977), grapevines respond favourably to NPK fertilization (Holladay 1893, Levinski 1960, Arutyunyan 1964). However, in view of changing fertilizer technology and reduced availability of traditional sources of N, P and K, organics are assuming greater importance. Studies were, therefore, conducted to gain information on the efficiency of various organo-mineral sources of N, P and K on the yield, fruit characters and quality of Perlette grape in Meerut region.

Table 1

Effect of different organo-mineral fertilizers on yield and yield contributory characters of Perlette grape

Einfluß verschiedener organisch-mineralischer Dünger auf Ertrag und ertragsbestimmende Merkmale bei der Rebensorte Perlette

Mean yield (kg)						Mean bunch number					
1973			1974			1973			1974		
T_{15}	8.87	a	T_{15}	14.80	a	T_{13}	46.60	a	T_{15}	68.30	a
T_{13}	8.29	b	T_{13}	14.50	b	T_{15}	44.00	b	T_{13}	64.30	b
T_3	7.56		T_{12}	12.80	c	T_3	34.30	a	T_6	61.60	
T_{12}	7.29	c	T_{16}	12.40	d	T_{12}	32.60	c	T_{12}	58.60	c
T_{14}	6.95	d	T_6	12.10		T_6	31.60	d	T_{16}	54.20	
T_4	6.50		T_{14}	12.10	a	T_9	31.40		T_9	52.50	
T_1	6.36		T_5	11.90	b	T_{14}	31.30		T_{14}	51.40	
T_{16}	6.35		T_9	11.40		T_1	31.20	b	T_5	50.70	
T_{11}	6.33		T_1	11.30		T_2	30.40		T_{11}	49.30	
T_9	6.27		T_{10}	11.20		T_{11}	30.20		T_7	48.30	a
T_6	6.23	a	T_3	11.20		T_{16}	29.20		T_1	48.00	
T_5	6.04		T_7	10.80		T_4	29.10		T_{10}	46.90	
T_2	5.83	b	T_{11}	10.80		T_5	28.10		T_3	46.20	
T_7	4.78	c	T_8	10.40		T_7	26.50		T_2	46.20	
T_8	4.46		T_2	10.00	c	T_8	24.20	c	T_8	44.40	b
T_{10}	4.32	d	T_4	9.60	d	T_{10}	19.70	d	T_4	40.80	c
SE/M	1.00		SE/M	1.04		SE/M	4.76		SE/M	7.26	
C.D. 5%	2.27		C.D. 5%	2.88		C.D. 5%	13.19		C.D. 5%	20.16	

Materials and methods

The plant material and the methods for field experimentation were the same as reported in part I of this paper (LAVANIA and SINGH 1977). Yields were measured in the years 1972—73 and 1973—74 by recording the number of bunches and their weight. For assessing the influence of treatments on the fruit quality, physico-chemical analyses on ripe berries were carried out in the month of June in both the years. The data on physical characters, viz. bunch length, bunch diameter, bunch volume and bunch weight were recorded on three bunches per plot. Berry diameter and berry weight were found by taking the average of ten berries selected at random. Acidity was estimated as per cent tartaric acid by titrating 10 ml juice against 0.1 N sodium hydroxide. Total soluble solids (TSS) were determined by using a hand refractometer. Non-reducing sugars, reducing sugars and total sugars were estimated by LANE and EYNON (1969) general volumetric method.

Results

1. Effect on yield

The data in Table 1 show that in 1973 maximum yield (8.87 kg/plant) was observed under T_{15} followed by T_{13}, T_3 and T_{12} in descending order. These treatments did not differ significantly among themselves. T_{15} differed significantly from treat-

Table 2

Effect of different organo-mineral fertilizers on bunch diameter and bunch length of Perlette grape

Einfluß verschiedener organisch-mineralischer Dünger auf Traubendurchmesser und -länge bei der Rebensorte Perlette

Mean bunch diameter (cm)				Mean bunch length (cm)			
1973		1974		1973		1974	
T_{15}	10.37 a	T_{15}	8.99 a	T_{12}	18.37 a	T_{15}	17.95 a
T_1	9.33 b	T_6	8.72 b	T_4	17.99 b	T_{13}	17.73 b
T_9	9.20 a c	T_{13}	8.68	T_5	17.63	T_7	17.62
T_{11}	9.15 d	T_5	8.42 c	T_9	17.63	T_8	17.54
T_4	9.12	T_{12}	8.39	T_{11}	17.44 c	T_{12}	17.44
T_8	9.06	T_3	8.10 d	T_{15}	17.33	T_6	17.30
T_2	8.90 e	T_{10}	8.10	T_3	17.22	T_3	16.79 c
T_3	8.82 f	T_4	8.09	T_{13}	17.18	T_9	16.62
T_7	8.57 g	T_7	7.98	T_1	17.12	T_{14}	16.44
T_5	8.15 b	T_9	7.94	T_{14}	16.97	T_5	16.24
T_{10}	8.12 c	T_{16}	7.93 a	T_8	16.93	T_{10}	16.20
T_{12}	7.96 d	T_{14}	7.51	T_{16}	16.17 a	T_4	16.17 a
T_6	7.80 e	T_1	7.41 b	T_2	16.09	T_{11}	15.75 b
T_{13}	7.62 f	T_2	7.17 c	T_7	16.08	T_1	15.24
T_{16}	7.54	T_{11}	7.04	T_{10}	16.03 b	T_{16}	15.02
T_{14}	6.51 g	T_8	6.92 d	T_6	15.30 c	T_2	14.90 c
SE/M	0.44	SE/M	0.49	SE/M	0.81	SE/M	0.73
C.D. 5%	1.21	C.D. 5%	1.35	C.D. 5%	2.24	C.D. 5%	2.02

ment nos. 5, 2, 7, 8 and 10, T_{13} from treatment nos. 7, 8 and 10, and T_3 from treatment nos. 5, 8 and 10.

Data for the year 1974 (Table 1) also show that T_{15} and T_{13} maintained their superiority in this respect in the succeeding year as well. T_3 which had maintained the third position in the year 1973, however, did not show good results in the year 1974 and occupied the eleventh position. T_{12} took lead over T_3 in the second year but the differences were not significant. However, T_{12} had performed well in the previous year and maintained its yield in the following year, showing consistency in its performance.

It was important to note that T_1, which was completely inorganic in source, maintained consistency in performance of plants in both the years, occupying the seventh and ninth positions in 1973 and 1974, respectively, and was found significantly inferior to T_{15} in the year 1974.

2. Effect on bunch number

The perusal of the data in Table 1 shows that in the year 1973 T_{13} produced the highest number of bunches and was found significantly superior to treatment nos. 12, 6, 9, 14, 1, 2, 11, 16, 4, 5, 7, 8 and 10. T_{15} and T_3, however, fell in the same group.

Data for the year 1974 (Table 1) also indicated that T_{15} and T_{13} maintained their superiority in the succeeding year as well. Although T_{15} took lead over T_{13}, the differences were not significant. It is interesting to note that T_{12}, T_9 and T_{14} maintained consistency in performance of plants in both the years occupying the fourth, sixth and seventh positions in descending order. Another interesting finding, which

Table 3

Effect of different organo-mineral fertilizers on bunch weight and bunch volume of Perlette grape

Einfluß verschiedener organisch-mineralischer Dünger auf Traubengewicht- und -volumen bei der Rebensorte Perlette

Mean bunch weight (g)						Mean bunch volume (ml)					
1973			1974			1973			1974		
T_{12}	330.50	a	T_{15}	383.50	a	T_{12}	302.00	a	T_{15}	352.00	a
T_{15}	299.00	b	T_{13}	382.00		T_{15}	277.00	b	T_{13}	350.50	
T_9	284.50	c	T_{12}	350.50	b	T_9	257.50	c	T_{12}	304.50	b
T_{13}	270.50	d	T_6	324.50	c	T_{13}	257.00	a	T_6	291.50	
T_8	264.50	a	T_5	294.50	a	T_{11}	235.50	d	T_5	258.00	a c
T_1	257.50		T_7	276.00	d	T_1	235.00		T_4	245.50	
T_{11}	257.00		T_4	273.50	e	T_8	228.00		T_7	241.30	
T_2	246.50	e	T_3	273.00		T_5	218.00	e	T_3	235.00	
T_5	243.50	b	T_{16}	258.50		T_2	216.50	b	T_{10}	230.00	
T_4	226.00		T_9	256.00		T_4	198.50		T_{16}	225.50	
T_7	225.50		T_{10}	255.00	b	T_{10}	195.00		T_9	216.50	
T_3	224.50		T_{14}	239.00	c	T_7	193.00	c	T_{14}	207.50	b
T_{10}	222.00	c	T_8	215.00		T_3	187.00		T_2	183.50	
T_{14}	209.50		T_2	212.50		T_{14}	181.50		T_8	175.50	
T_{16}	208.00	d	T_1	201.50	d	T_{16}	180.50	d	T_1	171.04	
T_6	180.80	e	T_{11}	192.50	e	T_6	158.50	e	T_{11}	163.50	c
SE/M	23.84		SE/M	36.34		SE/M	23.54		SE/M	35.28	
C.D. 5%	66.08		C.D. 5%	100.72		C.D. 5%	65.25		C.D. 5%	97.79	

comes out from the above data, is that T_1, completely inorganic in source, did not stand anywhere as regards the number of bunches per plant. It occupied the eighth position in the first year and the eleventh position in the second year in order of merit.

3. Effect on bunch diameter

It is evident from the data in Table 2 that T_{15} consistently produced a high mean diameter of bunches in both the years. T_7 produced consistent results by occupying the ninth position in both the years. There was no consistency in behaviour of plants under other treatments. Also, there appears to be no correlation between bunch diameter and its weight or volume. T_1 (standard treatment) occupied the second position in the first year and the thirteenth position in the second year and was found to be significantly inferior to T_{15} in the year 1974.

4. Effect on bunch length

A close scrutiny of the data presented in Table 2 indicates that T_{15} and T_{13} produced the longest bunches in 1973—74, whereas in 1972—73 T_{12} and T_4 produced the longest bunches. There was no consistency in behaviour of plants under other treatments in both the years. T_1 (standard treatment) had the second position in the first year and the thirteenth position in the second year and was found significantly inferior to T_{15} in the year 1974.

5. Effect on bunch weight

The data on bunch weight for the years 1972—73 and 1973—74 indicate that T_{15}, T_{12} and T_{13} produced heaviest bunches in both the years, although their positions

Table 4

Effect of different organo-mineral fertilizers on berry diameter and berry weight of Perlette grape

Einfluß verschiedener organisch-mineralischer Dünger auf Beerendurchmesser und -gewicht bei der Rebensorte Perlette

Mean berry diameter (cm)				Mean berry weight (g)			
1973		1974		1973		1974	
T_{15}	1.30 a	T_{15}	1.41 a	T_{15}	1.31 a	T_{15}	1.63 a
T_9	1.24 b	T_{13}	1.40 b	T_{13}	1.29 b	T_{13}	1.60 b
T_{12}	1.23	T_{12}	1.39 c	T_3	1.28 c	T_{12}	1.57 c
T_{14}	1.23	T_{11}	1.37 d	T_{11}	1.28	T_{11}	1.57
T_7	1.21 c	T_{14}	1.36	T_9	1.27 a d	T_{14}	1.53
T_{11}	1.20	T_2	1.35	T_6	1.26 e	T_2	1.50
T_3	1.19 d	T_4	1.34	T_{14}	1.26	T_{10}	1.49
T_2	1.19 a	T_{10}	1.33	T_7	1.26	T_4	1.47
T_{13}	1.16	T_5	1.33	T_2	1.26	T_3	1.46
T_{16}	1.14 e	T_{16}	1.32	T_{12}	1.25 b	T_8	1.45
T_8	1.13 b	T_8	1.32	T_8	1.24 c f	T_5	1.44
T_6	1.10	T_3	1.32 a	T_6	1.23	T_{16}	1.43
T_1	1.09 c	T_6	1.30	T_4	1.23	T_9	1.42
T_{10}	1.07 d	T_9	1.30 b	T_1	1.23 d	T_7	1.40 a
T_5	1.03	T_7	1.29 c	T_5	1.22 e	T_6	1.39 b
T_4	1.02 e	T_1	1.27 d	T_{10}	1.20 f	T_1	1.35 c
SE/M	0.07	SE/M	0.04	SE/M	0.02	SE/M	0.09
C.D. 5%	0.13	C.D. 5%	0.11	C.D. 5%	0.05	C.D. 5%	0.24

were not consistent. T_{15}, having the second position during 1972—73, occupied the first position during 1973—74, whereas T_{12} occupying the first position during 1972—73 had the third position during 1973—74. T_{13} occupied the fourth and second positions during 1972—73 and 1973—74, respectively. While the positions of the rest of the treatments changed in both the years, there were interesting indications of position of T_1, T_2 and T_{11}, which had the sixth, eighth and seventh positions during 1972—73 and the fifteenth, fourteenth and sixteenth during 1973—74, respectively.

6. Effect on bunch volume

The perusal of the data in Table 3 shows that T_{15}, T_{13} and T_{12} produced bunches of high volume consistently in both the years, although their positions were not consistent. T_{15} having the second position during 1972—73 occupied the first position in 1973—74. T_{13} occupied the fourth position during 1972—73 and the second position during 1973—74. Similarly, T_{12} occupied the first position in 1972—73 and the third position in 1973—74. T_1 (standard treatment) which had maintained the sixth position in the first year, however, did not give good response in the second year and went down to the fifteenth position.

7. Effect on berry diameter

The data on berry diameter for both the years indicate that T_{15} and T_{12} consistently produced a high diameter of berries in the years 1972—73 and 1973—74. T_{13} which was observed to be superior in respect of yield and number of bunches

Table 5

Effect of different organo-mineral fertilizers on fruit quality of Perlette grape

Einfluß verschiedener organisch-mineralischer Dünger auf die Beerenqualität bei der Rebensorte Perlette

Acidity (%)						Total soluble solids (%)					
1973			1974			1973			1974		
T_1	0.55	a	T_1	0.44	a	T_{15}	21.15	a	T_{15}	21.85	a
T_2	0.53	b	T_2	0.43		T_{16}	20.89	b	T_{16}	20.84	a b
T_4	0.53		T_4	0.43		T_{10}	20.80		T_{10}	20.76	
T_3	0.52	a	T_7	0.43		T_{11}	20.40	c	T_{11}	20.65	
T_7	0.51	b	T_9	0.43		T_{13}	20.25		T_{13}	20.14	
T_9	0.46	c	T_3	0.42	b	T_{14}	20.16		T_8	19.94	c
T_6	0.46		T_6	0.42		T_8	20.14		T_{14}	19.84	b d
T_{12}	0.46		T_{12}	0.42		T_5	20.00		T_{12}	19.45	
T_{14}	0.46		T_{14}	0.41	a c	T_7	19.63		T_5	19.43	
T_5	0.46		T_5	0.40	d	T_4	19.50	a	T_6	19.32	c e
T_{13}	0.46		T_{13}	0.40		T_9	19.32	b	T_4	18.86	
T_8	0.46		T_8	0.40		T_6	18.86	c	T_7	18.86	
T_{11}	0.45	c d	T_{11}	0.40		T_{12}	16.63	d	T_9	18.48	
T_{16}	0.42		T_{16}	0.40	b	T_1	16.21		T_3	18.48	d
T_{10}	0.42	d	T_{10}	0.38	c	T_2	15.90		T_2	18.36	
T_{15}	0.36		T_{15}	0.37	d	T_3	15.58	d	T_1	18.35	e
SE/M	0.02		SE/M	0.01		SE/M	0.64		SE/M	0.38	
C.D. 5%	0.04		C.D. 5%	0.04		C.D. 5%	1.80		C.D. 5%	1.02	

produced berries of a bigger diameter, occupying the second position in 1974, but in the year 1973, its performance was much below expectation (ninth position) and thus the results of two years were not consistent in this respect. No striking feature was observed with other treatments which were quite inconsistent in their performance. T_1 (standard treatment) produced berries of very small size in both the years.

8. Effect on berry weight

The perusal of the data in Table 4 shows that T_{15}, T_{13} and T_{11} had consistently produced the heaviest berries occupying the first, second and fourth positions in both the years. The lighter berries were produced by T_1 (standard treatment) and its positions had been the fourteenth and sixteenth during the successive years meaning thereby that it has no effect on the weight of berries. The positions of the rest of the treatments were not consistent and changed in both the years considerably.

9. Effect on fruit quality

The data in Tables 5, 6 and 7 indicate that treatment nos. 1, 2 and 4 produced maximum acidity with low content of various sugars in both the years. Treatments 15, 16, 10, 11 and 13, in both the years, brought about significantly higher TSS, reducing sugars, non-reducing sugars, total sugars and lower acidity. Similar, but less marked effects were also noticed in case of the other treatments.

Table 6

Effect of different organo-mineral fertilizers on fruit quality of Perlette grape
Einfluß verschiedener organisch-mineralischer Dünger auf die Beerenqualität bei der Rebensorte Perlette

Reducing sugars (%) 1973			Reducing sugars (%) 1974			Non-reducing sugars (%) 1973			Non-reducing sugars (%) 1974		
T_{15}	15.71	a	T_{15}	19.03	a	T_{16}	5.22	a	T_{16}	2.16	a
T_7	14.84	b	T_{11}	18.54	b	T_{10}	4.74	b	T_{13}	1.80	b
T_{13}	14.80		T_{10}	18.06	c	T_{15}	4.43	c	T_{14}	1.65	
T_{16}	14.77		T_{16}	17.82	a	T_{11}	4.35	a	T_{10}	1.64	
T_{11}	14.55	a c	T_{13}	17.19	d	T_4	4.00		T_{15}	1.60	
T_5	14.49		T_5	17.14		T_{14}	3.96	b	T_{12}	1.60	
T_8	14.46		T_8	17.12		T_8	3.69		T_8	1.59	
T_{14}	14.28	d	T_{14}	17.12	b	T_{13}	3.64		T_6	1.50	c
T_{10}	14.22		T_{12}	16.66		T_9	3.57		T_4	1.49	
T_9	13.84	b e	T_2	16.64		T_5	3.53		T_3	1.43	a
T_4	13.54	c f	T_6	16.61		T_6	3.43	c	T_7	1.32	
T_6	13.25	d g	T_7	16.52		T_3	3.41	d	T_9	1.31	
T_1	12.66	e	T_4	16.44	c	T_7	2.85	e f	T_1	1.30	
T_{12}	12.36	f	T_9	16.14		T_{12}	2.29	g	T_5	1.29	
T_2	12.27		T_3	15.92		T_2	1.57	f	T_{11}	1.09	b
T_3	12.13	g	T_1	15.83	d	T_1	1.39	g	T_2	0.80	c
SE/M	0.43		SE/M	0.60		SE/M	0.39		SE/M	0.27	
C.D. 5%	1.19		C.D. 5%	1.66		C.D. 5%	1.02		C.D. 5%	0.74	

Discussion

The present studies reveal that the yield obtained from the plants under T_{15} was highest in both the years, closely followed by T_{13} and T_{12}. It appears that bloodmeal and neemcake do not give any response singly or in combination, but when combined with bonemeal, they resulted in maximum yield. Cheema *et al.* (1954), Ahmad (1960) and Gaffar and Zende (1971) pointed out that bloodmeal in combination with various organic phosphates increased yield.

In the present investigations T_{10}, which lacks inorganic phosphate, failed to give satisfactory yield. The presence of inorganic phosphate in organic manures increases the yield efficiency. This can be attributed to the fact that superphosphate acts as a preservative and prevents volatilization of gases including ammonia. Simultaneously, P_2O_5 is not fixed in the soil and is interlocked with the organic matter and thus becomes easily available for plant growth (Dutt 1961, Lamba and Verma 1962).

It was also noted that the magnitude of response was highest in grapes with the application of bonemeal in combination with bloodmeal and neemcake. Holladay (1893) also reported that an addition of bloodmeal to a mixture of inorganic fertilizers and organic manures resulted in increased yield of grape. Similarly, Gaffar and Zende (1971) pointed out that bloodmeal in combination with calcium phosphate or slacked lime showed higher recovery of N. The effect of N on yield characters could be attributed to increased synthesis of amino acids, increased growth, increased leaf surface and thus increased photosynthesis.

Table 7

Effect of different organo-mineral fertilizers on fruit quality of Perlette grape
Einfluß verschiedener organisch-mineralischer Dünger auf die Beerenqualität bei der Rebensorte Perlette

Total sugars (%)					
1973			1974		
T_{15}	20.13	a	T_{15}	20.73	a
T_{16}	19.99	b	T_{16}	19.97	b
T_{10}	19.09	c	T_{10}	19.72	c
T_{11}	18.90		T_{11}	19.62	d
T_{13}	18.45	a d	T_{13}	19.00	a e
T_{14}	18.32	b	T_{14}	18.84	f
T_8	18.11		T_8	18.71	
T_5	18.09		T_5	18.43	
T_7	17.70		T_{12}	18.26	
T_4	17.55		T_6	18.20	b
T_9	17.42	c	T_4	17.93	c
T_6	16.76	d e	T_7	17.85	d
T_3	15.54	e f	T_9	17.45	
T_{12}	14.73		T_3	17.35	
T_1	14.05		T_2	17.35	e
T_2	13.85	f	T_1	17.14	f
SE/M	0.64		SE/M	0.67	
C.D. 5%	1.78		C.D. 5%	1.85	

RAGAB and HABEEB (1961) reported significant differences between the number of bunches produced by organic manures and inorganic fertilizers. GOURLEY (1934), LEVINSKI (1960), ARUTYUNYAN (1964), MARTIN and STETAN (1967) and PEYER and ZWICKY (1972) also observed profitable response from organo-mineral fertilizers in grapes. These findings support the results obtained in the present investigation, in which the maximum number of bunches was obtained from the plants under T_{15} and T_{13}. It is, therefore, evident that different treatments like T_{15} and T_{13} have a dominating effect on bunch production in grapes and results vary from treatment to treatment. These observations are again supported by SINGH *et al.* (1963) and SERPUKHOVITINA (1965).

BAKSHI and CHADHA (1968) reported that addition of organic matter like organic manures to inorganic fertilizers helps in producing long and heavy bunches and shows better plant response than the application of organic manure or inorganic fertilizers alone. This conforms with the observations of the present trial.

The effect of T_{15} and T_{13} on bunch weight and bunch volume was also very encouraging. Findings further show that the application of the same treatments caused significant improvement in the bunch length and bunch diameter. These results are supported by the findings of GAFFAR and ZENDE (1971) who found maximum weight, length, diameter and volume of cobs treated with a mixture of blood-meal and superphosphate.

T_{15} gave maximum increase in breadth and weight of berry followed by T_{13} and T_{12} (Table 4). T_1 (standard treatment) gave smaller sized berries in comparison to other treatments. As reported earlier (LAVANIA and SINGH 1977) T_{15} increased

growth and fruit bearing surface. Consequently, there is a high leaf to fruit ratio leading to an increase in size of berries. That the berry grade is improved by organo-mineral fertilizers application was also reported by AHMAD (1960) and CHEEMA *et al.* (1954).

Data presented in Table 5 indicate that high TSS and low acid content in grape juice were associated with T_{15}. Leaf analysis has shown a high NPK status under T_{15} (unpublished data). BALLINGER *et al.* (1966) reported an inverse relationship between acidity and leaf- or fruit-N content while BUCHER (1969) reported an increase in TSS with increase in leaf-N. The present findings are thus in conformity with the results reported by earlier workers.

It is clear from the data presented in Table 7 that T_{15}, T_{16}, T_{10}, T_{11} and T_{13} increased the sugar content significantly as compared to T_1 (completely inorganic in source). Besides these, other treatments like T_8 and T_5 also produced berries with higher sugar contents. It appears that in the present studies the highest sugar percentage in berries resulted with the treatments having bloodmeal alone or in combination with bonemeal. This can be explained on the ground that bloodmeal is rich in micronutrients, especially iron. It is an established fact that iron is credited with definite role in the formation of chlorophyll molecules in plants. This subsequently promotes higher photosynthetic efficiency. HARAS (1960) suggested that externally applied iron increases the redox potential of chlorotic leaves, which in turn causes increase in the rate of chlorophyll synthesis and ultimately the increase in photosynthetic activity.

Summary

The present study on grape nutrition was carried out with a view to find out the effects of different organo-mineral fertilizers on yield and quality of Perlette grape. The results obtained are summarized below.

T_{15} (bonemeal 0.5 kg + neemcake 0.5 kg + bloodmeal 0.5 kg + calcium ammonium nitrate 0.990 kg + superphosphate 0.456 kg + muriate of potash 0.813 kg) gave maximum number of bunches per plant followed by T_{13} (bonemeal 0.5 kg + bloodmeal 0.5 kg + calcium ammonium nitrate 1.22 kg + superphosphate 0.487 kg + muriate of potash 0.825 kg) in the year 1973—74 while in the year 1972—73 they exchanged their positions. The same treatments also produced the longest bunches having maximum diameter in both the years. Mean weight of the bunches and volume of bunches were also highest under T_{15}, closely followed by T_{13} and T_{12} (bonemeal 0.5 kg + neemcake 0.5 kg + calcium ammonium nitrate 1.014 kg + superphosphate 0.500 kg + muriate of potash 0.822 kg). As a consequence, maximum yield was recorded under T_{15}, followed by T_{13}. Maximum TSS content was observed under T_{15} and maximum acidity under T_1 (calcium ammonium nitrate 1.22 kg + superphosphate 0.782 kg + muriate of potash 0.833 kg). Maximum total sugar content and reducing sugar content were noted under T_{15} while maximum non-reducing sugar content was observed under T_{16} (farm yard manure 8 kg + bonemeal 0.5 kg + neemcake 0.5 kg + bloodmeal 0.5 kg + calcium ammonium nitrate 0.629 kg + muriate of potash 0.640 kg).

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