JOURNAL OF AGRICULTURE & SOCIAL SCIENCES
1813–2235/2005/01–2–114–116
http://www.ijabjass.org

Cultural Practices for Production Manipulation in Grapes Cv. Anab-e-Shahi

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ABSTRACT

Manipulation of growth for better production through cultural practices was studied in grape cv. Anab-e-Shahi. Shoots were pruned at 15th or 20th node. Lateral re-growth was continuously removed until the shoots attained cane maturity. Maximum re-growth (%age) was recorded at terminal nodes i.e. close to the site of pruning in either case. Shoots with less number of nodes had more re-growth (%age) than the shoots with more nodes. Terminal nodes re-grow continuously in both types of shoots. Shoots pruned at 15th nodes attained more thickness (1.54 cm) than those pruned at 20th node. Shoots defoliated on different dates after maturation had 1.29-1.44% nitrogen, 0.33-0.50% phosphorous and 2.25-3.61% potassium. Vines failed to bloom although shoots had attained the desired maturity (cane thickness and nutrient status).

Key Words: Grapes; Anab-e-Shahi; Production; Pruning; Growth; Vegetative; Reproductive

INTRODUCTION

The grapes, being the native of warm temperate zone between 34°N and 49°S latitude, require long warm to hot, dry summer and cool winter; the conditions found in Quetta (Balochistan) and some areas of North West Frontier Province (NWFP), Pakistan. Pakistan is producing 51.8 thousand tons of grapes annually, with an average yield of 19 tonnes/ha against the potential of 25 tonnes/ha (Anonymous, 2004). Production of grapes can be increased by increasing per unit area production. Although, central Punjab has nearly suitable climate for grape cultivation, but "monsoon" rains at the time of berry ripening is the main calamity for the restricted cultivation of grapes in Punjab province. Yet, the production can be manipulated by altering the cultural practices to delay blooming as Beniwal *et al*. (1989) got two crops in one year by pruning the grape cv. 'Perlette' in mid July, after 12 buds (nodes) per cane. So, flowering can be delayed in areas where rains are problem at the time of ripening. The desired cane maturity (120 days old shoots) can be achieved by pruning and defoliation as higher photosynthetic rates in defoliated vines were observed by Hunter and Visser (1988), which could help in shoot maturation. Prolonged photosynthetic activity was observed after partial defoliation and drop in nitrogen contents of the remaining leaves was reduced. Keeping in view the possibility of two crops in one year and higher photosynthetic activity after defoliation, grape vines of cv. Anab-e-Shahi were pruned and defoliated to suppress the first crop for getting a second crop. The basic theme of study was to get a commercial crop in Punjab, which could escape from "moon soon" rains at the time of ripening.

MATERIALS AND METHODS

The study to manipulate grape production under the agro-climatic conditions of Punjab (Pakistan) was conducted during the year 1999. It was consisted of two experiments.

Experiment No. 1. Shoots of the grape cv. Anab-e-Shahi were pruned at two different nodal lengths i.e., pruning of shoots at 15th node and pruning of shoots at 20th node. After pruning, lateral growth was removed continuously at weekly interval in order to mature the shoots for blooming. Re-growth pattern of the laterals in different nodes was noted up to the end of August; shoot thickness was measured and compared with untreated shoots.

Experiment No. 2. Shoots were pruned at two different nodal lengths i.e. at 15th and 20th node, and laterals were removed continuously with weekly interval, until June. Later on, the laterals were not removed but the shoots were defoliated on 15th June (T_1), 1st July (T_2) and 15th July (T_3). Re-growth of leaves after defoliation was noted. Samples of re-grown leaves were analyzed for NPK contents by the methods used by Chapman and Parker (1961) and Yoshida *et al*. (1976) to assess the shoot maturity for blooming. Data on shoot thickness and NPK contents of leaves were statistically analyzed using Fisher's analysis of variance technique and Duncan's Multiple Range (DMR) test at 5% probability to compare the treatment means (Petersen, 1994).

RESULTS AND DISCUSSION

Re-growth pattern of the vines. Terminal nodes showed maximum lateral re-growth (Table I) in both the treatments. Node number 12, 13, 14 and 15 of the vines pruned after 15th node had 0.80 (9.10%), 1.13 (12.82%), 2.08 (23.54%) and 2.70 (30.56%) re-grown laterals (Re-growth percentage in parenthesis). Similarly, the vines pruned after 20th nodes had maximum re-growth at last three nodes i.e. 18th, 19th and 20th nodes, which had 1.13 (10.77%), 1.75 (16.65%) and 1.75 (16.65%) re-growth, respectively. Re-growth of laterals decreased in nodes number from tip to the base of the

pruned branches, with exceptional cases like N_8 (5.88% re-growth) and N_6 (5.82% re-growth) in shoots pruned on 15th and 20th node, respectively. It revealed that the effect of pruning i.e. breakage of apical dominance was more pronounced in the nodes close to the site of pruning and this effect was almost masked in basal nodes. Moreover, it was also obvious that re-growth of laterals in different node was affected by the number of nodes on the pruned branches. Branch with more nodes had less re-growth per node than the branch with less number of nodes. In T_1, 9.10, 12.82, 23.54 and 30.56% re-growth was observed in four terminal nodes as compared to 7.17, 10.77, 16.65 and 16.65% re-growth in T_2. Furthermore, terminal nodes in T_1 (N_{13}, N_{14} and N_{15}) and T_2 (N_{17}, N_{18}, N_{19} and N_{20}) had continuous re-growth through out the season (Table II & III). No continuous re-growth was observed in all other nodes of the two treatments.

No particular sequence was observed in the re-growth of the vines when re-growth of laterals was compared on different dates (Table IV). Maximum lateral growth was noted after pruning and re-growth percentage decreased gradually later on. Almost similar pattern was observed in T_2. So, re-growth of laterals after pruning is not time related but might be affected by some other agro-climatic factors.

Shoot thickness. After pruning the main shoots at different positions, lateral growth on these shoots was removed continuously in order to attain the maturity comparable to cane. Shoots of maximum thickness (1.54 cm) were found in T_1 (Table V) followed by T_2 (1.35 cm). Unpruned shoots in which laterals were not removed had minimum thickness (1.12 cm). Shoot thickness might be correlated with re-growth percentage as pruned shoots with fewer nodes (T_1) had more re-growth percentage as well as thickness than a pruned shoots with more nodes (T_2). Shoots attained as much thickness as that of a mature cane i.e. 1.2-1.4 cm, which is the most suitable thickness in Anab-e-Shahi for more number of laterals and number of flower buds per lateral (Bindra, 1980). But all the vines in two treatments failed to bloom.

Re-growth of leaves. Leaves started developing a week after defoliation. Leaf re-growth pattern was similar in the

Table I. Effect of pruning on re-growth of the vines

Node	T_1		T_2	
	Re-grown laterals	Re-growth (% age)	Re-grown laterals	Re-growth (% age)
N_1	0.09	1.06	0.00	0.00
N_2	0.23	2.66	0.00	0.00
N_3	0.14	1.60	0.09	0.90
N_4	0.00	0.00	0.14	1.34
N_5	0.09	1.06	0.37	3.57
N_6	0.00	0.00	0.61	5.82
N_7	0.14	1.60	0.42	4.01
N_8	0.52	5.88	0.28	2.68
N_9	0.33	3.73	0.23	2.24
N_{10}	0.28	3.20	0.33	3.13
N_{11}	0.28	3.18	0.33	3.14
N_{12}	0.80	9.10	0.23	2.23
N_{13}	1.13	12.82	0.28	2.68
N_{14}	2.08	23.54	0.56	5.37
N_{15}	2.70	30.56	0.66	6.29
N_{16}	-	-	0.56	5.37
N_{17}	-	-	0.75	7.17
N_{18}	-	-	1.13	10.77
N_{19}	-	-	1.75	16.65
N_{20}	-	-	1.75	16.65
Total	8.85	-	10.54	-

Table II. Comparison of re-growth (%age) at different nodes as affected by pruning at 15th node

Nodes / Dates	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}	N_{14}	N_{15}
3/5	0.00	3.41	0.00	0.00	0.00	0.00	0.00	3.41	3.41	3.41	3.41	6.90	13.74	13.81	48.43
10/5	4.12	4.12	0.00	0.00	0.00	0.00	0.00	4.12	8.34	0.00	0.00	0.00	12.46	16.59	54.25
18/5	0.00	0.00	0.00	0.00	6.20	0.00	0.00	0.00	0.00	6.20	0.00	6.20	12.53	43.79	25.06
27/5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.02	18.23	18.23	18.23	36.27
4/6	6.20	12.53	12.53	0.00	6.20	0.00	6.20	0.00	0.00	0.00	0.00	12.53	12.53	12.53	18.73
12/6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.45	16.54	33.45	16.54
21/6	0.00	9.03	0.00	0.00	0.00	0.00	0.00	18.26	0.00	0.00	9.03	0.00	9.03	27.30	27.30
30/6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00	50.00	0.00
8/7	0.00	0.00	12.43	0.00	0.00	0.00	0.00	25.13	12.43	0.00	0.00	0.00	12.43	25.13	12.43
15/7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.91	40.08
22/7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.55	4.72	4.72	4.72	23.843	19.01	23.84	9.55
30/7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.91	19.91	19.91	40.25
6/8	0.00	0.00	0.00	0.00	0.00	0.00	16.60	33.56	16.60	0.00	116.60	0.00	0.00	16.60	0.00
15/8	0.23	0.14	0.00	0.09	0.00	0.14	0.52	0.33	0.33	0.28	0.28	0.80	1.13	2.08	2.70

Table III. Comparison of re-growth (%age) at different nodes as affected by pruning at 20th node

Nodes / Dates	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}	N_{14}	N_{15}	N_{16}	N_{17}	N_{18}	N_{19}	N_{20}
10/5	0.00	0.00	0.00	4.31	0.00	4.31	4.31	4.31	4.31	0.00	0.00	0.00	8.73	0.00	0.00	4.31	8.73	4.31	17.37	34.92
18/5	0.00	0.00	0.00	2.48	5.01	9.97	2.48	2.48	0.00	2.48	2.48	2.48	0.00	12.50	7.49	2.48	2.48	15.03	12.55	17.57
27/5	0.00	0.00	4.96	0.00	4.96	4.96	4.96	0.00	0.00	10.04	4.96	0.00	4.96	0.00	0.00	4.96	4.96	10.04	15.01	25.15
4/6	0.00	0.00	0.00	0.00	9.03	18.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.03	0.00	0.00	9.03	9.03	36.53	9.03
12/6	0.00	0.00	0.00	0.00	7.66	7.66	0.00	15.49	7.66	7.66	0.00	7.66	0.00	0.00	7.66	7.66	7.66	0.00	15.49	7.66
21/6	0.00	0.00	7.08	0.00	0.00	0.00	7.08	0.00	7.08	7.08	14.32	0.00	0.00	0.00	21.56	0.00	14.32	0.00	14.32	7.08
30/6	0.00	0.00	0.00	0.00	0.00	0.00	33.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.90	0.00
8/7	0.00	0.00	0.00	0.00	9.95	0.00	9.95	0.00	0.00	0.00	0.00	0.00	9.95	0.00	20.12	9.95	9.95	9.95	0.00	20.12
15/7	0.00	0.00	0.00	0.00	0.00	11.05	11.05	0.00	0.00	0.00	0.00	0.00	0.00	11.05	0.00	0.00	11.05	11.05	22.35	22.35
22/7	0.00	0.00	0.00	4.14	0.00	8.37	4.14	4.14	8.37	4.14	4.14	4.14	4.14	4.14	8.37	8.37	4.14	12.51	8.37	8.37
30/7	0.00	0.00	0.00	0.00	3.67	0.00	0.00	3.67	0.00	3.67	7.43	3.67	3.67	3.67	11.11	14.86	7.43	11.11	14.86	11.11
6/8	0.00	0.00	0.00	0.00	4.72	4.72	4.72	0.00	0.00	0.00	0.00	4.72	0.00	14.28	0.00	0.00	9.55	14.28	23.84	19.11
15/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.43	12.43	37.56	25.13	12.43

two treatments i.e. 5.25 and 5.00, 5.50 and 6.25 and 2.25 and 5.50 leaves in T_1, T_2 and T_3 shoots pruned at 15th and 20th nodes, respectively (Table VI). Less leaf growth in T_1 in shoots pruned on 15th day might be due to localized stress. So, leaf growth after defoliation is not affected by the number of nodes on shoot. No blooming was observed on these shoots up to the end of growing season.

NPK contents of leaves. Re-grown leaves were sampled and analyzed for their NPK status. Pruning and the following defoliation significantly affected NPK contents of leaves (Table VII). Similar results have also been reported by Bertamint *et al*. (1995). Nitrogen contents of the leaves were maximum (1.46%) in T_3, and statistically similar to T_1 (1.43%). Although, nitrogen status of leaves in T_2 was in normal range (1.29%) but statistically significant to T_1 and T_3. Leaves of un-defoliated shoots have 0.45% nitrogen.

Leaves of shoots defoliated on 15th June (T_1) had highest phosphorous contents (0.50%) followed by T_3 (0.49%). While phosphorous contents were least (0.33%) in leaves of un-defoliated shoots. Phosphorous contents in the leaves of shoots defoliated on 1st July (T_2) were 0.42%. Level of potassium was highest in T_3 (3.61%) and lowest (2.25%) in un-defoliated shoots. Potassium contents were statistically alike in T_1 (3.16%) and T_2 (3.25%). It revealed that defoliation in mid June and mid July had similar effect on nitrogen and phosphorous contents while potassium contents were alike in shoots defoliated on mid June and 1st July. Although, our results are supported by the findings of Bhargava and Raghupathi (1992) that NPK contents in high yielding vines of grape cv. Anab-e-Shahi were in the range of 0.93-1.51%, 0.31-0.60% and1.32-3.70% respectively, yet vines failed to bloom.

Failure of vines to bloom indicates that second crop in cultivar Anab-e-Shahi is not possible under the environmental conditions of Punjab. Failure of blooming might be due to low level of starch reserves, caused by severe defoliation, as reported by Candolifi-Vasconcelos and Koblet (1990). Moreover, Anab-e-Shahi is a late maturing cultivar as compared to Perlette; so it is difficult to get two crops in one year (Beniwal *et al*., 1989). There might be a problem of Red Cane, already reported by Winkler *et al*. (1974) in Anab-e-Shahi, the conditions in which the shoots failed to mature physiologically. So, more research is needed to discover the hidden facts.

Table IV. Effect of pruning on vine re-growth at different times during the growing season

Dates	T_1	T_2
03-05-99	1.37 (15.58%)	-
10-05-99	1.18 (13.42%)	1.08 (10.30%)
18-05-99	0.75 (8.53%)	1.89 (18.01%)
27-05-99	0.52 (5.92 %)	0.94 (8.96%)
04-06-99	1.23 (13.99%)	0.52 (4.96%)
12-06-99	0.75 (8.53%)	0.61 (5.81%)
21-06-99	0.28 (3.19%)	0.66 (6.29%)
30-06-99	0.52 (5.92%)	0.14 (1.33%)
08-07-99	0.09 (1.02 %)	0.47 (4.48%)
15-07-99	0.37 (4.21%)	0.42 (4.00%)
22-07-99	0.23 (2.62%)	1.13 (10.77%)
30-07-99	0.99 (11.26%)	1.27 (12.11%)
06-08-99	0.23 (2.62%)	0.99 (9.44%)
15-08-99	0.28 (3.19%)	0.37 (3.53%)
Total	8.79	10.49

Table V. Effect of pruning on shoot thickness (cm)

Treatments	Shoot thickness (cm)
T_0	1.12 c
T_1	1.54 a
T_2	1.36 b

Table VI. Effect of defoliation on re-growth of leaves at different times and blooming

Time of Defoliation	15-6-99		01-07-99		15-07-99	
Time of re-growth	T_1	T_2	T_1	T_2	T_1	T_2
21-06-99	2.25	2.25	-	-	-	-
28-06-99	4.00	3.75	-	-	-	-
04-07-99	5.25	4.75	2.00	2.00	-	-
11-07-99	5.25	5.00	3.50	3.50	-	-
18-07-99	5.25	5.00	5.00	5.25	1.00	1.75
25-07-99	No inflorescence		5.50	6.25	1.25	3.50
01-08-99	-	-	5.50	6.25	2.00	4.25
09-08-99	-	-	No inflorescence		2.25	5.50
17-08-99	-	-	-	-	2.25	5.50
25-08-99	-	-	-	-	No inflorescence	

Table VII. Effect of pruning on NPK contents of Anab-e-Shahi leaves

Treatments	N (%)	P (%)	K (%)
T_0	0.45 c	0.33 c	2.25 c
T_1	1.43 a	0.50 a	3.16 b
T_2	1.29 b	0.42 b	3.25 b
T_3	1.46 a	0.49 a	3.61 a

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(Received 10 September 2004; Accepted 12 November 2004)