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Mechanical Bench Grafting for Apple Propagation

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Abstract: Mechanically and manually prepared stock and scion for bench grafting were adopted in four phases for apple propagation i.e., mechanically made stock and manually prepared scion, second phase was vice versa while in third stage both the stock and scion were prepared mechanically. In fourth operation all the grafting process was performed by hand made scion and stock. Maximum sprouting and success percentage of 93.2 and 83.2 respectively was recorded in the mechanically prepared scion and stock. Results proved that this operation was also the most efficient which took 95.4 minutes only to graft hundred plants of apple. In conclusion mechanical technique for bench grafting in apple propagation was recorded as the best and efficient method.

Key words: Bench grafting, stock and scion, cambial contact, success percentage

Introduction

Apple is considered as king of deciduous fruits. It can be grown in a wide range of soil and climate and its propagation is made through various methods. Apple plants produced through seed are not true to type like parent plants. Asexually produced plants are always true to type like that of scion Cv. Usually good quality plants are produced through budding and grafting. Bench grafting is more popular method of apple propagation which is widely used during early spring by plant propagators. It is highly technical laborious and time consuming method of propagation when performed manually.

Various kinds of machines are being used for efficient grafting. Labor and time is also saved along with efficient results. Efficiency of a mechanical cutter was standardized for apple propagation in these studies. A uniform and smooth mechanically made cut on the scion and stock surface makes the graft union more successful as compared with uneven grafting cut made by grafting knife used manually. L.B grafting tool, making a V. notch in root stock and corresponding long, tapered cut at the base of scion, was most successfully for grafting grapes and fruit trees (Alley, 1957). A machine powered by an electric motor having two sets of saw blades on a single shaft for cutting notches one in the base of scion and one in the top end of root stock worked more efficiently by saving time and labor cost with successful results of bench grafting in apple (Wahler, 1970). The stock scion relationships are important to the success of a graft. There must be a cambial contact of stock and scion union and growth of each was greatly aided by smooth cuts with a sharp knife (Denisen, 1979). A smooth and firm intimate cambial contact of scion and stock union enhances the healing process and results in successful grafting in peach (Hortmann and Bentel, 1979). The cut surface of scion and stock should be flat and smooth for better results in bench grafts made with the help of machines are more precise and efficient with very high rates of success (Chadha and Shikhamany, 1999). Mechanical grafting technique used for grape cultivars proved that the operation resulted in maximum grafting success and quality of grafted vines was also improved (Cangi *et al.*, 1999).

Materials and Methods

These studies were carried out on Horticultural Research Station Nowshera (Soan valley) Khushab during the year 2000 and 2001 with the objective to evaluate the efficiency of mechanical for bench grafting in apple nursery. Pencil size crab apple (rootstock) plants were grafted with Anna cv. of apple through bench grafting method in last week January of respective year. Four treatments were repeated for five times in the experiment. In first treatment scion was prepared by mechanical means and stock was prepared manually. In second treatment, it was vice versa approach. Stock and scion were mechanically prepared in third treatment while stock and scion were manually prepared in the fourth treatment. Prepared scion piece was fitted firmly in prepared end of stock and graft wound was wrapped by 24 cm

long jute thread (Seba). Grafted plants were planted in the nursery soil bed 15 cm apart in rows of 25 cm width. Plants were planted so deep that graft would be buried in the soil. Standardized nursery management practices were adopted during the growth period of the research material under observation. Hundred plants were included in each treatment and in this way two thousands plants were treated in the experiment. Only one bud was engaged for grafting operation. Time was noted at the start and end of the grafting operation for recording of time consumed for mechanical and manual bench grafting techniques for hundred plants in each treatment. Data regarding sprouting percentage was recorded in second week of March for the respective year while the data for success percentage was noted in last week of September for respective year. The experiment in the nursery was laid out in a randomized complete block design (RCBD) with five replications and data was analyzed by analysis of variance (Gomez and Gomez, 1984). The treatment means were compared by Duncan, new multiple range test (DMRT).

Results

Sprouting percentage: Sprouting percentage proved the superiority of mechanical method than manually prepared scion and stock as highly significant statistically in bench grafting operation (Table 1). Mechanically produced scion and stock had the highest % age (93.2) while it was recorded as the lowest for the same operation performed manually with the minimum sprouting percentage (66.6) only. Individually prepared stock and scion with machine and its counterpart made manually could not produce any significant difference with (80.6) and (81.4) percent sprouting success respectively.

Success percentage: Results proved that maximum success (88.20 %) was recorded where both scion and stock were prepared mechanically while minimum success (48.80 %) was noted where bench grafting technique was performed manually (Table 2). As for as individual mechanical method for stock and scion preparation is concerned along with the counterpart made manually their success percentage was recorded at par statistically with 56.00 and 55.20 % respectively.

Time factor: A thorough study of results prove that mechanical operation of bench grafting is the most efficient methodology which took only 95.40 minutes for completion of the operation for 100 plants of apple (Table 3). Results proved that manually prepared stock and scion were more laborious and time consuming which took a maximum period of 192.20 minutes for completion of the bench grafting operation. Results of mechanically prepared stock and scion along with manually made counterpart took a period of 124.00 minutes and 127.40 minutes as operation duration and these are statistically at par with one another.

Sumrah *et al.*: Bench grafting, stock and scion, cambial contact, success percentage

Table 1: Effect of mechanical operation on sprouting % age of apple nursery

Treatments	Years		Means
	2000	2001	
Mechanically prepared stock	81.75	79.45	80.60b
Mechanically prepared scion	81.70	81.10	81.40b
Mechanically prepared stock and scion	93.55	92.85	93.20a
Manually prepared stock and scion	68.33	64.87	66.60c

Table 2: Effect of mechanical operation on success %age of apple nursery

Treatments	Years		Means
	2000	2001	
Mechanically prepared stock	56.25	55.75	56.00b
Mechanically prepared scion	55.18	55.22	55.20b
Mechanically prepared stock and scion	88.75	87.65	88.20a
Manually prepared stock	50.17	47.43	48.80c

Table 3: Effect of mechanical operation on time required for completion of operation

Treatments	Years		Means
	2000	2001	
Mechanically prepared stock	125.72	122.28	124.00b
Mechanically prepared scion	128.32	126.48	127.40b
Mechanically prepared stock and scion	96.70	94.10	95.40c
Manually prepared stock and scion	193.10	191.30	192.20a

Means having different letters are significantly different at $P < 0.05$

Discussion

Bench grafting technique is in use since long for propagation of apple like deciduous fruit plants. It is a cumbersome, time consuming and laborious methodology with moderate success results. Comparative evaluation of manual and mechanical methods adopted for scion and stock preparation in the research trial proved that maximum sprouting and success percentage was recorded where scion and stock both were prepared mechanically. It was due to the reason that this technique is more efficient, highly precise, uniform and provides maximum space for the cambial contact of scion and stock. The results enumerated are in consonance with those of Alley (1957), Wahler (1970) and Hartmann and Bentel (1979). These results are in consonance with the results reported by Canggi *et al.* (1999).

In conclusion maximum sprouting and success percentage of apple nursery was recorded in mechanically prepared scion and stock when it was compared with those prepared by hand. Mechanical bench grafting is more effective, efficient and gives relatively highest output in apple propagation as compared with conventional manual grafting practice.

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