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REJUVENATION OF NAGPUR MANDARIN (*Citrus reticulata* Blanco.) THROUGH TOP WORKING

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ABSTRACT : The experiment was carried out at the farmers' field at Nimoda and Ummedpura villages, Jhalrapatan, Jhalawar during the year 2009-10. Eight years old declining plants of Nagpur Mandarin were subjected to different time of top working. It was observed that 15th October time of budding had significantly better effect on budding performance, growth and in turn rejuvenation of plants. Maximum bud take per cent (75.80%), minimum days required to first sprouting (18.27 days), minimum days required to 50 per cent sprouting (53.26 days) and the maximum budding success (70.23%) were recorded in 15th October budding time. Under this treatment maximum length of sprout shoot (14.19cm), diameter of sprout shoot (4.97), number of nodes (11.04), length of internodes (1.29cm), number of leaves on sprout shoots (15.23), leaf area (15.23 cm^2), perimeter of leaves (20.25cm) and chlorophyll content (3.704 mg/g) were noted.

Keywords : *Rejuvenation, Nagpur Mandarin, top working, budding.*

Nagpur Mandarin (*Citrus reticulata* Blanco.) is the most valued member of citrus group. It belongs to the family Rutaceae. Mahararashtra, Rajasthan, Karnataka, Madhya Pradesh, Nagaland, West Bengal, Assam, Meghalaya and Tripura are the major mandarin producing states in the country. Mandarin fruits are rich in calcium and potassium. They are mostly consumed as fresh. Fruits are processed into various products and by-products. Essential oil and pulp are major by-products. Essential oils are used in cosmetics, soaps, perfumes and aromatherapy and for pharmaceutical purposes. The essential oil possesses anti-fungal property against phytopathogens. Being useful in one way or the other, fruits remain in high demand. To cope up with the demand there is a need to increase production and productivity. Ofcourse, there are many reasons for low productivity, but the malady of citrus decline is the major contributing factor. All citrus species and varieties are susceptible to decline, but the mandarins are the most susceptible, followed by sweet oranges. The causes of this problem are still unknown. It may be due to several reasons such as mismanagement of the orchard, improper soil type, poor drainage, nutritional deficiencies, insects and diseases etc. Rejuvenation is resorted as an alternative to bring back the plant in its normal capability. It is attempted by top working. Top working being feasible, these may be made use in averting the declining situation in citrus orchard provided extent of decline, age of tree, soil and climate conditions etc also favours. Keeping all these considerations in notion the present investigation was attempted so as to observe the efficacy of pruning on rejuvenation of the declining mandarin.

MATERIALS AND METHODS

The experiment was carried out in declining orchard of mandarin selecting eight years old trees during the year 2009-10 at the farmers' field at Nimoda and Ummedpura villages, Jhalrapatan, Jhalawar. The treatment consisted of five time of budding *i.e.,* 15th September, 1st October, 15th October, 1st November and 15th November 2010. With three plants as an experimental unit and five replications, total 75 plants among declining plants were selected for the study. Observations on budding performance and vegetative growth were recorded and analysed statistically.

RESULTS AND DISCUSSION

Budding performance

The maximum bud take percentage (75.80 %), minimum days required to first sprouting (18.27), 50 % sprouting (53.23) and budding success (70.23 %) were observed when budding was done on 15th October (Table 1 and Fig.1). Such results might be due to rapid and complete union of xylem and cambium tissues favouring closer matching of the scion to the rootstock tissue (Hartmann *et al.*, 3). The low bud-take percentage as observed in case of 15th September might be due to low callus formation (Hartmann *et al.,* 3) under comparatively higher temperature prevailed during the period as compared to 15th October budding. Morton *et al.* (5) observed the role of weather

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Table 1: Effect of time of budding on budding performance of stem parameters in Nagpur Mandarin.

Budding time	Bud take percentage (%)	Days required to first sprouting	Days required to 50 % sprouting	Budding success (%)
15th Sept	62.43	23.09	59.72	43.47
1st Oct.	63.55	20.87	55.33	53.23
15th Oct.	75.80	18.27	53.26	70.23
1st Nov.	68.36	25.18	92.19	34.55
15th Nov.	66.29	27.46	95.09	25.19
CD (P=0.05)	0.311	0.250	0.403	0.347

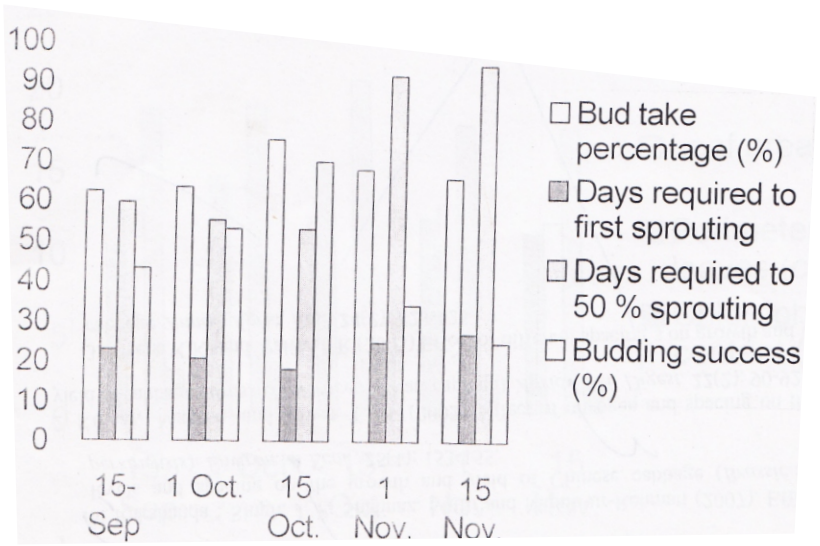

Fig. 1. Effect of time of budding on budding performance of stem parameters in Nagpur Mandarin.

in bud union and sprouting in custard apple. Budding attributes being dependent upon climate conditions especially temperature, humidity, rainfall, sunshine hours etc, the optimum climatic condition as prevailed during October might favoured better response as observed under 15th October budding treatment. Hartmann *et al.* (3) reported 24-28°C temperature optimum for budding which coincides with the available temperature prevailed during October. Less bud take and budding success with September budding might be due to comparatively higher prevailing temperature and also occurrence of rain attributing rotting and thus failureness of budding performed during the period. Bruno (1) reported poor bud break in rainy season (May–September) owing to *Fusarium* and *Phytophthora* infections. Decline in per cent bud sprouting during second week of September due to unfavorable weather conditions has also been recorded by Singh *et al.* (9) in aonla. The findings of present investigation are in consonance with the results as observed by Mukherjee and Singh (6) who reported best results by budding Sweet orange (cv. Pineapple) on *C. jambhiri* rootstock in October under Delhi condition.

Stem parameters

The length and diameter of newly emerged shoot got influenced significantly by time of budding (Table 2 and Fig.2). As regard to the effect of time of budding on the length (14.19 cm) and diameter (4.97 mm) of newly emerged shoot, it was observed that plant when budded was done on 15th October had significantly

Table 2: Effect of time of budding on growth performance of stem parameters in Nagpur Mandarin.

Budding time	Length (cm)	Diameter (mm)	No. of nodes	Length of internodes (cm)
15th Sept	11.98	4.22	9.30	1.26
1st Oct.	12.82	4.55	10.18	1.27
15th Oct.	14.19	4.97	11.04	1.29
1st Nov.	11.42	4.10	8.98	1.25
15th Nov.	10.23	3.92	8.03	1.23
CD (P=0.05)	0.1372	0.0311	0.1181	0.0102

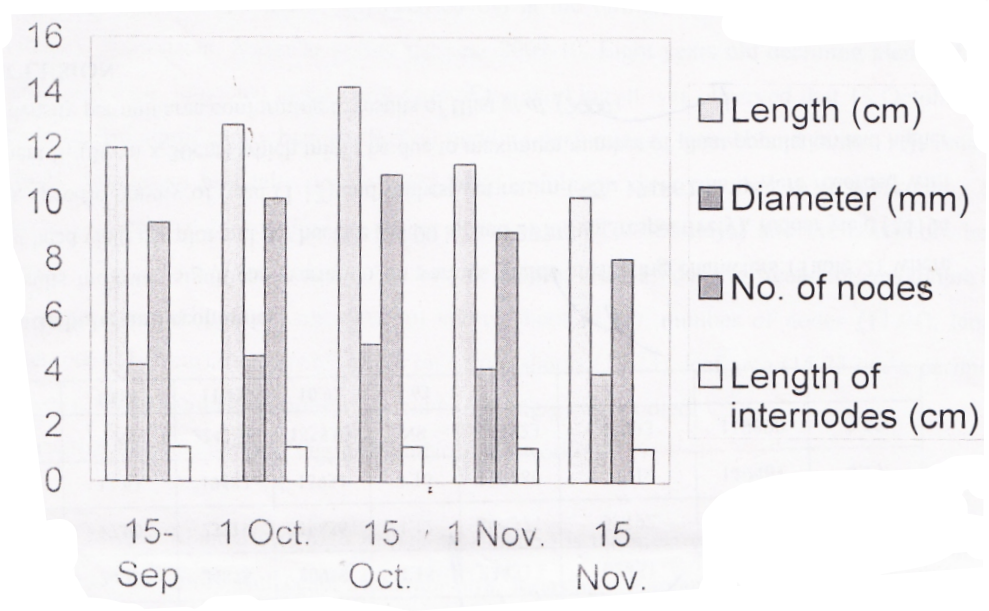

Fig. 2 : Effect of time of budding on growth performance of stem parametes in Nagpur Mandarin.

higher length of scion shoot. It may be due to quick and strong formation of union between the rootstock and bud and increased sap flow (Skene *et al.,* 13) and subsequently due to greater utilization of nutrient by sprouted shoot. The prevalent climatic conditions during October might favour maximum length and diameter of scion shoot, during growth phase of scion. The results are in conformity to the results as observed by Pandey and Prasad (7). The data on number of nodes and length of internodes were influenced significantly by different periods of budding. With, 15 October budding, maximum number of nodes (11.04) and length of internodes (1.29 cm) was recorded. The role of low temperature in restriction of growth has been highlighted by Singh (11). Like this Singh *et al.,* (12), and Kumar and Shukla (4) also found significant effect of time of budding and grafting on various attributes of aonla and custard apple, respectively.

Leaf parameters

Number of leaves, leaf area and other leaf parameters got influenced significantly by time of budding (Table 3 and Fig.3). The maximum number of leaves on sprouted scion (15.29), leaf area (15.23cm^2), perimeter of leaves (20.25 cm) and chlorophyll content (3.704 mg/g) were recorded when budding was done on 15th October. It may be due to absorption and translocation of nutrients besides photosynthate ability might got promoted by more number of leaves on the scion shoot. The role of leaves in photosynthetic production and consequently growth has been highlighted by Sestak (8). Significant variation in height, number of leaves, length of nodes and number of nodes were noted with advancement of growing periods. It may be due to on going development process accounting to cell division, expansion and differentiation governing size, shape and structure of plants (Taiz and Zeiger, 14). The discernible positive correlation of number of nodes, length of nodes and number of leaves with height may be explained in the light of photosynthates etc assimilation and the subsequent energy generation. The role of energy in regulation of growth has been narrated by Singh (10). These may be explained in the back drop of prevailing growth conditions afterwards budding. The results obtained are in accordance with

Table 3: Effect of time of budding on growth performance of leaf parameters in Nagpur Mandarin.

Budding time	Number of leaves	Leaf area (cm)	Perimeter of leaves (cm)	Chlorophyll content (mg/g)
15th Sept	12.89	13.33	18.69	2.928
1st Oct.	14.62	13.93	18.93	3.340
15th Oct.	15.29	15.23	20.25	3.704
1st Nov.	11.84	12.71	17.47	2.438
15th Nov.	10.85	11.52	17.16	2.205
CD (P = 0.05)	0.1602	0.1901	0.1718	0.0442

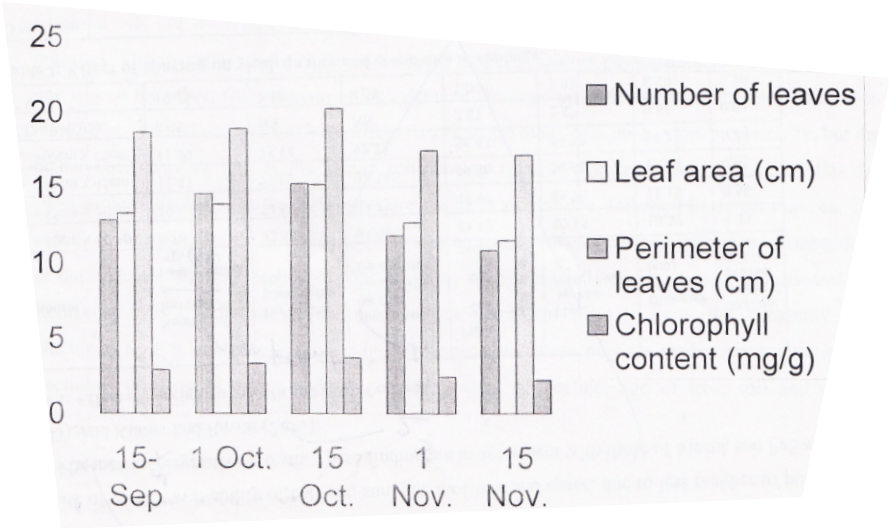

Fig. 3 : Effect of time of budding on growth performance of leaf parameters in Nagpur Mandarin.

the earlier findings as quoted by Dubey and Singh (2). The maximum chlorophyll content (4.263 mg/g) was found when budding was done on 15 th October. It may be due to temperature dependent better synthesis of chlorophyll in leaves on shoots appeared after budding and their better resumed growth budding afterwards.

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