

# Effect of budding performed by hand and with manual grafting unit on kiwifruit propagation in the field

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**ABSTRACT:** The kiwifruit cultivar Hayward was grafted on three-year-old seedling rootstocks of the same cultivar in field conditions. Inverted T-budding, chip-budding, conventional local T-budding by hand and chip-budding with manual grafting unit were used as budding types. All budding operations were done on the 15<sup>th</sup> May in 2002 and 2003. The hand chip-budding gave the highest bud-take (98.34%), sprouting rate (91.67%), shoot diameter (6.84 mm) and shoot length (58.07 cm). The manual chip-budding grafting unit also performed well but it was more time consuming and gave lower graft success.

**Keywords:** *Actinidia*; machine and hand budding; budding; field conditions; bud-take

Kiwifruit has gained a worldwide popularity in the recent past because of its wider climatic adaptability, delicious fruits with a unique blend of taste, precocity and high nutritive and medicinal values. Studies and evolutions proved that kiwifruit cultivation has very high returns per unit area. This is the reason why fruit growers are showing a keen interest in this fruit. The biggest obstruction in the expansion of growing area is the scarcity of the planting material. Kiwifruit could be propagated either from cuttings (softwood and hardwood) or by grafting and budding (SALE 1985; LAWES 1992). Grafting the desired variety onto a seedling rootstock is a general commercial practice because *Actinidia* cuttings root fairly readily from hardwood or softwood cuttings (DIAZ HERNANDEZ, GARCIA BERRIOS 1997). As a result, a very low number of plants is produced, which is relatively negligible in relation to a huge demand. Seedlings also have vigour and longer roots than cuttings (OZCAN 2000). Therefore the study was conducted to examine the success of budding types done in the springtime and to determine the usability of manual grafting unit for budding operations in kiwifruit propagation.

## MATERIAL AND METHODS

Three-year-old kiwifruit seedlings having a uniform girth were used as stock plants. They were grown in two-gallon pots containing equal volumes

of soil, sand and farmyard manure. Sand had no organic material while farmyard manure contained 83.8% water, 0.29% nitrogen, 0.17% phosphorus, 0.10% potassium and 0.34% calcium. Scion woods were selected the previous winter from vigorous productive plants grown in the kiwi orchard of Atatürk, Tea and Horticultural Plants Research Institute in Rize, Turkey. They were packed in damp sawdust and stored in a cold storage at 0–1°C until the beginning of the study (STRIK, CAHN 1996). T-budding and inverted T-budding were performed by hand and chip-budding was performed by hand and with manual grafting unit (by Carlo A. Manaresi, Unit. Art. 43) (Fig. 1). All budding operations were done on the 15<sup>th</sup> May (ZENGINBAL 1998). Soft white plastic tapes were used to wrap the budding. Maximum, minimum and mean temperature (°C) and relative humidity (%) were recorded during two months after grafting (Figs. 2 and 3).

The experiment was laid out in a randomized block design with 3 replications and 10 plants per replication. Cultural operations such as irrigation, weeding and removal of suckers below the graft union followed at regular intervals. Data on sprouting were recorded after bud burst, while bud-take success was recorded 3 months after graft budding. Observations of shoot length and diameter were carried out in December. Data expressed as a percentage were transformed using the  $\text{arc-sin}\sqrt{x}$  transformation, and statistical analyses of thusly transformed data

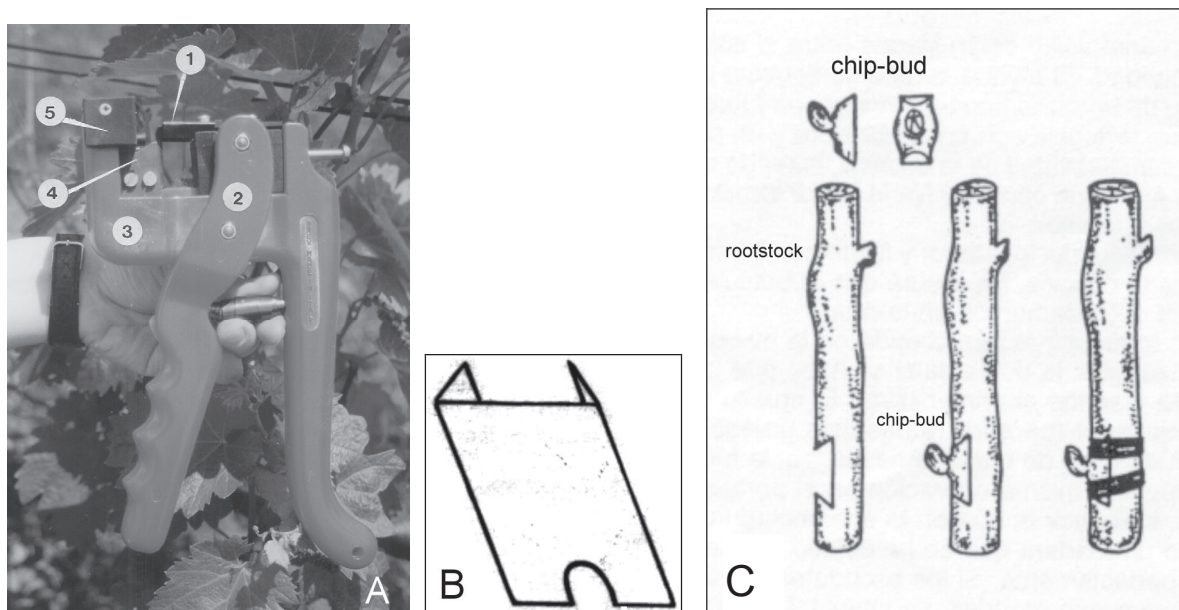


Fig. 1. Manual grafting unit (A: 1 – blade, 2 and 3 – handles, 4 – extractor, 5 – Arnitel block), trapezoid shaped blade (B) and grafting stages (C)

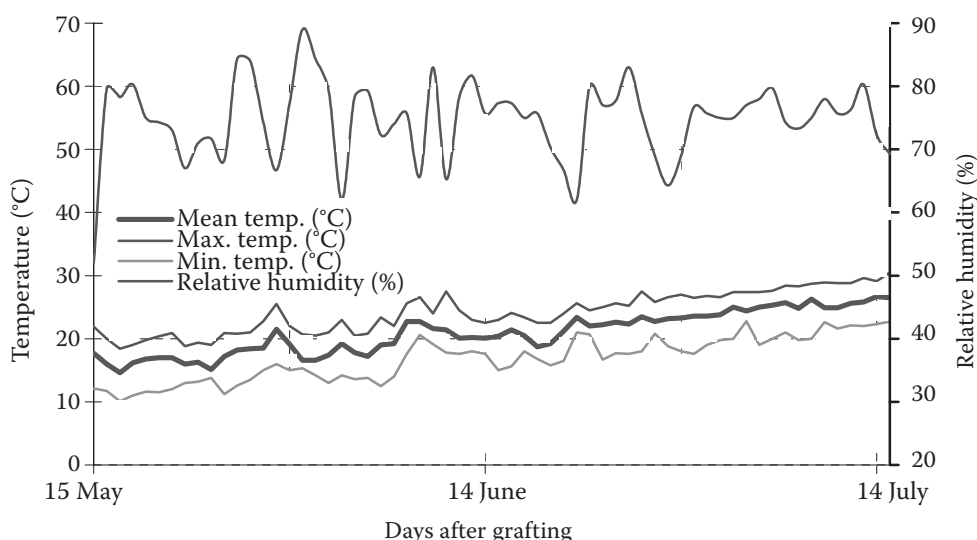


Fig. 2. Variations of mean, maximum and minimum daily temperatures and relative humidity during the days after grafting (2002)

were done by MSTAT-C pocket program (Russell D. Freed, Crop and Soil Sciences Department, Michigan State University). Duncan's Multiple Range Test was used to indicate the differences between the average data.

## RESULTS AND DISCUSSION

The bud-take success and sprouting were significantly influenced by different budding methods of propagation (Table 1). The highest mean bud-take (96.67% and 100% in 2002 and 2003, respectively) and sprouting (90% and 93.33% in 2002 and 2003, re-

spectively) were recorded for hand chip-budding. It was followed by chip-budding with the manual grafting unit (83.33% in 2002) and by inverted T-budding (73.33% in 2003). However, there were no significant differences between the other budding types except for chip-budding performed by hand (Table 1). This can be attributed to the desiccation of T-buds because of their smaller wood part and/or to a penetration of rainwater to the graft union. Very poor bud-take and sprouting were recorded for T-budding. Among all the methods, chip-budding performed by hand gave overall better bud-take results compared to chip-budding with the manual grafting

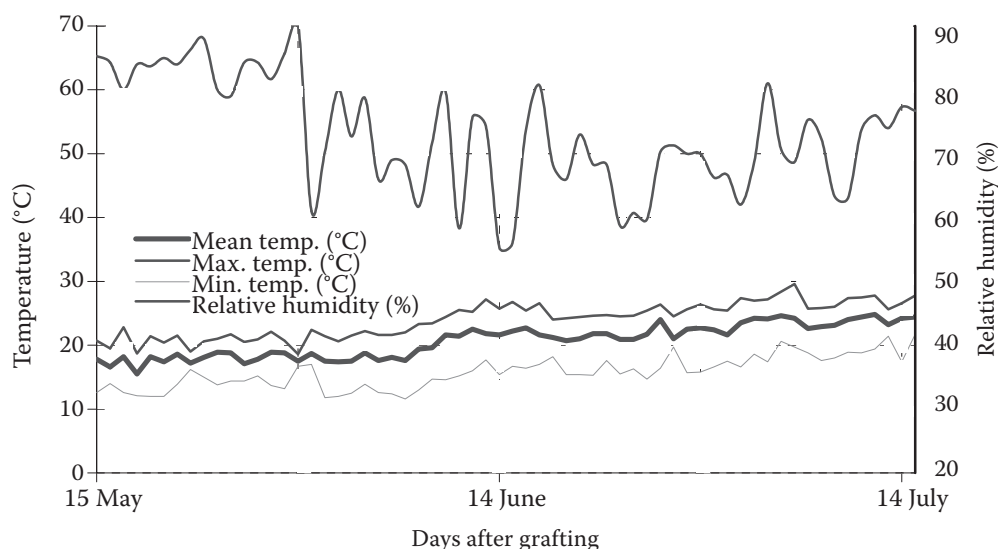


Fig. 3. Variations of mean, maximum and minimum daily temperatures and relative humidity during the days after grafting (2003)

Table 1. Effect of different budding methods on bud-take, sprouting and growth of grafts in kiwifruit

Treatment	Bud-take (%)		Sprouting (%)		Shoot length (cm)		Shoot diameter (mm)	
	2002	2003	2002	2003	2002	2003	2002	2003
Chip-budding with machine	83.33 <b>b*</b> (66.15)**	60.00 <b>b</b> (50.85)	63.33 <b>b</b> (52.78)	26.67 <b>b</b> (30.99)	38.00	40.75	5.91	6.65 <b>b</b>
Chip-budding by hand	96.67 <b>a</b> (83.86)	100.00 <b>a</b> (90.00)	90.00 <b>a</b> (71.57)	93.33 <b>a</b> (77.71)	53.33	62.81	6.49	7.31 <b>a</b>
T-budding	70.00 <b>b</b> (57.00)	66.67 <b>b</b> (54.78)	60.00 <b>b</b> (50.94)	53.33 <b>b</b> (46.92)	41.67	43.18	6.36	6.45 <b>b</b>
Inverted T-budding	80.00 <b>b</b> (63.93)	73.33 <b>b</b> (59.01)	63.33 <b>b</b> (52.78)	63.33 <b>ab</b> (52.86)	43.32	45.33	6.43	6.63 <b>b</b>
LSD	1% = 15.29	1% = 12.59	5% = 11.93	1% = 25.67	NS	NS	NS	5% = 0.55

\*there are no significant differences between data given in the column, \*\*transformed data, NS – not significant

unit, T-budding and inverted T-budding. These findings are in conformity with those of LAWES and SIM (1980), SPIROVSKA et al. (1993) and CHANDEL et al. (1998), who found that chip-budding gave very good results in kiwifruit in terms of bud-take.

The data reveal that only the linear shoot growth of grafted plants was significantly affected by budding methods (Table 1). The maximum shoot length (53.33 and 62.81 cm in 2002 and 2003, respectively) and shoot diameter (6.49 and 7.31 mm in 2002 and 2003, respectively) were attained by chip-budding performed by hand. While comparing various methods of grafting and budding KIM et al. (1989) and CHANDEL et al. (1998) also obtained the maximum growth of plants with chip-budding. The quick and strong union formation, higher uptake of water and nutrients and longer growing period may account for the higher growth of chip-budded plants. On the other hand, the manual grafting unit affected the buds and made

deep wounds on the rootstock wood. We believe that it had a negative effect on graft healing, take and cambial connectivity, and the shoot growth and development were lowered, as was also reported by SCENE et al. (1983). Besides, PERUZZO and DALBO (1992) emphasised the importance of preventing the fungal infection of the graft union. It was also found that in relation to bud-take and sprouting the inverted T-budding was more effective than locally used T-budding (Table 1).

In conclusion, chip-budding by hand gave better results of kiwifruit grafting under field conditions. The manual graft unit needs a further examination with harder stock and scion plant parts.

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## Efekt ručního očkování a očkování prováděného roubovacím strojem při rozmnožování kiwi v polních podmínkách

**ABSTRAKT:** Na tříleté podnože kiwi odrůdy Hayward byl v polních podmínkách roubován stejnojmenný kultivar. Bylo použito techniky obráceného T řezu, plátkování a normálního T řezu, které bylo děláno ručně. Plátkování bylo pak provedeno i strojově. Očkování proběhlo 15. května 2002 a 2003. Ručně prováděné plátkování poskytovalo nejvyšší ujímání oček (98,34 %), největší rychlost rašení (91,67 %), šířku prýtů (6,84 mm) a délku prýtů (58,07 cm). S menšími účinky byl také využit přístroj na ruční plátkování.

**Klíčová slova:** *Actinidia*; strojové a ruční očkování; očkování; polní podmínky; ujmnutí očka

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