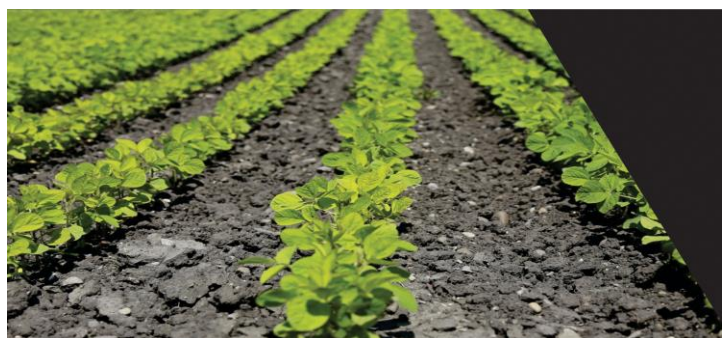




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Studies on success of wedge graft of different Custard apple (*Annona Squamosa* L.) cultivars

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Abstract

A field experiment studies was conducted on success of wedge graft of different custard apple (*Annona Squamosa* L.) cultivars was undertaken at the nursery, Department of Fruit Science, KNK College of Horticulture, Mandsaur (M.P.) during 2022-2023. The experiment was conducted in a completely randomized design and 08 treatments viz. Balanager, Arka Sahan, Annona -2, NMK - 1, APL -1, NMK -3, Saraswati -7 and Chandisili at nursery stage with three replications. The results indicated that the minimum number of days required to start graft sprouting (11.67 DAG) and days taken to 50% sprouting (14.00 DAG) were recorded in T₁ (Balanagar) and number of buds sprouted (5.97), number of shoots per graft (4.33), highest length of longest shoot (7.38 cm), number of leaves per graft (15.33), leaf area (37.09 cm²), SPAD value (34.94), scion girth (0.70 cm), root stock girth 0.89 (cm), fresh weight of shoot (18.36 g), dry weight of shoot (5.25 g), stionic ratio (0.82) and success percentage (94.44%) were recorded in treatment T₅ (Arka Sahan). Arka Sahan was the best performing when grafted on local type rootstock in agro-climatic condition of malwa plateau region.

Keywords: Bud, leaf area, stionic ratio, SPAD value, wedge grafting

Introduction

Custard apple (*Annona Squamosa* L.) is an important dry land fruit of India. It belongs to family Annonaceae. The genus includes more than 100 species of which five produce edible fruits. Among these *Annona Squamosa* L. (Custard apple) *Annona reticulata* (Bullock heart, Ramphal) and *Annona cherimola* (Hanumanphal) are commercially important. Sitaphal also known as Sugar apple, sweet soap in India and it is originated in Central America from there, it was distributed to Mexico and Tropical America (Popenoe, 1974) ^[1].

There are some minor fruit crops grown in India that are important to human health because they have nourishing, healing and health-promoting qualities but custard apple a well-balanced dry land fruit crop is among them. Custard apple rich in energy (104.0 kcal), moisture (70.5 g/100g), carbohydrate (23.5 g/100g), protein (1.60 g/100g), fat (0.4 g/100g), minerals (0.90 g/100g), calcium (17 mg/100g), phosphorus (47 mg/100g) iron (1.50 mg/100g) and good source of vitamin C (37.00 mg/100g), dietary fiber (3.10 g/100g), vitamin B₁ (0.07 mg/100), vitamin B₂ (0.17 mg/100g) and vitamin B₃ (1.30 mg/100g) (Gopalan *et al.*, 1987) ^[2].

Various components that influence custard apple production and productivity in the nation. However, the fundamental reason is a lack of superior variety planting material and knowledge on propagation and rootstock. Though seed propagation is currently used, it is not suitable for producing true-to-type planting materials due to heterozygous nature, high incidence of disease and insect.

Materials & methods

The study was conducted at the nursery, Department of Fruit Science, KNK College of Horticulture, Mandsaur, (M.P.). The nursery field is located in the tropical zones at altitude of 435.02 feet above mean sea level, 23.45° to 24.15° North latitude and 74.44° to 75.18° East longitude. The experiment was conducted in a Completely Randomized Design (CRD) with 3 replications and 8 treatments. Eight custard apple cultivars were grafted on local type rootstock in

agro-climatic condition of malwa plateau region at Department of Fruit Science, KNK College of Horticulture, Mandsaur, (M.P.). The wedge grafting was done on the selected rootstock seedling with taking care for selecting the scion material to match the girth of the stock. The wedge of stock split vertically in the form of cleft to a length of 4 to 5 cm downward with sharp knife. The cleft to a looked like a fork or letter “V” Scion was prepared by giving a cut in to gently sloping wedge of about 5 cm to the morphological base of the scion, by removing the bark and little wood from opposite sides. Care taken to retain some bark on the remaining two sides of the scion. The wedge - shaped scion thus prepared was inserted in to the “V” shaped split of stock and secured firmly with 2 cm wide white transparent polythene strip. Wedge grafting was done in the month of February 2023. At the

time of wedge grafting rootstock was 1year old and scion was collected 3 to 4-year-old plant at the time of grafting and collect from center of excellent of Custard apple Chittorgarh Rajasthan. Five plants were selected from each treatment to evolved the success rate and growth parameters of grafts. The growth parameters like number of days taken to start sprouting of graft, days taken to 50% sprouting, number of buds sprouted per graft, number of shoots per graft, length of longest shoot (cm), number of leaves per graft, leaf Area (cm²), SPAD value, scion girth, root stock girth, fresh weight of shoot (g), dry weight of shoot (g), stionic ratio and success percentage were recorded. The data were statistically analyzed followed the method suggested by Panse and Sukhtame (1996) ^[3].

Table 1: Characters of different Custard apple cultivars

Variety	Characters
T ₁ - Balanagar	The selection was identified at FRS, Sangareddy, A.P. TSS (28-30°Brix) with granular pulp texture and compact flakes, not easily loosen at ripping of fruit which is prime necessary character for custard apple processing.
T ₂ - Arka Saran	It is developed by IIHR, Bangalore. Average fruit weight is 410.0g. High TSS (30 °B), high pulp recovery (70.0%) and good shelf-life (6days). It requires assisted pollination for fruit set.
T ₃ - Annona -2	The variety is developed by a farmer in Solapur district of Maharashtra. The fruits have less seeds and fruit size ranges from 500 to 750 g, fruit yield 16 to 19 tons per hectare.
T ₄ - NMK -1	The cv. NMK-1 is a hybrid variety of custard apple developed by a research-oriented farmer. The fruits of this variety have fewer seeds, abundant pulp and rarely crack when ripe.
T ₅ - APK -1	It is a clonal selection from a high yielding type in the state horticultural farm, Court Allam. It bears higher yield in rainfed vertosol (black soil). It is a drought tolerant variety which bears sweet fruits (TSS of 24.5 °Brix with an acidity of 0.2 per cent). The fruit weigh about 207.5 g
T ₆ - NMK -3	This variety developed by maduvan farm, Sholapur (MH), pulp colour is pink and fruit colour black's red, average fruit weight 50-150 gm.
T ₇ - Saraswati -7	The fruit of Saraswati -7 is very big (500 g to 1100 g) with almost 80% pulp, fewer seeds, thin skin, less prominent eyes and low sweetness. It is good for processing, ice – cream and making juice
T ₈ - Chandsili	Large size fruit, average fruit weight 300-1100 gm, sugar contain 22-24% and pulp percentage 40-45%.
T ₄ - NMK -1	The cv. NMK-1 is a hybrid variety of custard apple developed by a research-oriented farmer. The fruits of this variety have fewer seeds, abundant pulp and rarely crack when ripe.
T ₅ - APK -1	It is a clonal selection from a high yielding type in the state horticultural farm, Court Allam. It bears higher yield in rainfed vertosol (black soil). It is a drought tolerant variety which bears sweet fruits (TSS of 24.5 °Brix with an acidity of 0.2 per cent). The fruit weigh about 207.5 g
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T ₈ - Chandsili	Large size fruit, average fruit weight 300-1100 gm, sugar contain 22-24% and pulp percentage 40-45%.

Result and discussion

Number of days taken to start sprouting and 50% sprouting of graft

The scion of cultivar Balanagar was recorded the minimum number of days to start sprouting and 50% sprouting of graft respectively, 11.67 DAG and 20.00 DAG (Day after grafting). The maximum number of days required to start graft sprouting was recorded in NMK-3 cultivar. These differences might be linked to scion genetic composition, which alters the histology and metabolic processes at graft union. The quicker physiological development and enhanced meristematic activity in the tissues of Balanagar may have aided in faster healing of the graft union, resulting in earlier scion sprouting compared to other treatments. Similar results were reported by Chauvatia and Singh (1999), Kudmulwar *et al.* (2008) ^[4], Khopade and Jadhav (2013)^[5], Kumar *et al.* (2014) ^[6], Pawar *et al.* (2018) ^[7] and Panchal *et al.* (2022) ^[8] in custard apple.

Number of buds sprouted and shoots per graft

Arka Sahan treatment was recorded the maximum number of buds sprouted *i.e.* 4.97 and 5.97 sprout per graft at 30 and 60 DAG, respectively and number of shoots *i.e.* 3.37 and 4.33 at 30 and 60 DAG. In the month of February environmental condition specially temperature and humidity are enough for buds to sprout development. Maximum number of shoots reported due to more active buds present in scions, improved vascular relations in the stocks and scion high carbohydrate accumulation at optimal temperature and relative humidity. The results are consistent with the findings reported by Kulkarni (1990) ^[9], Shinde *et al.* (2015) ^[10] in custard apple, Dhutraj *et al.* (2018) ^[11] in custard apple, Tanushree *et al.* (2019) ^[12] in jack fruit and Haricharan *et al.* (2021) in custard apple.

Length of longest shoot (cm)

At 60 DAG, the length of longest shoot (7.38 cm) was noted in Arka Sahan. The length of the shoot grown on the scion was much

longer in grafts prepared in March than in February and September and it was the shortest in grafts prepared in November. This might be because the vegetative buds dormant throughout the winter season began to shoot during the summer and early monsoon season, contributing to the grafts shoot length. Ismail and Rao (1989) ^[13] achieved similar results in the case of mango, Krishnamurthy *et al.* (1985) ^[14] in cashew and Bhuwa *et al.* (1990) in sapota.

Number of leaves and leaf area (cm²) per graft

The maximum number of leaves and leaf area (15.33) and (37.09 cm²) respectively was counted in Arka Sahan. Whereas, Saraswati-7 was counted the lowest number of leaves per graft. The number of leaves per graft grew as the sprouting percentage increased. Greater leaf area is closely connected with greater number of leaves in graft reported during these months, which might be attributed to higher stored food in scions and favorable environmental circumstances that promoted faster graft growth. The current experiment's findings align closely with those of T Sonika *et al.* (2015) in guava, as well as with the studies by Dhutraj *et al.* (2018) ^[11], Suman *et al.* (2022) ^[15], and Panchal *et al.* (2022) ^[8] in custard apple.

Spad Value

Treatment Arka Sahan was assessed maximum SPAD value (34.94) and the lowest SPAD value (29.89) was noted in Saraswati-7. The timing and technique of propagation had a significant influence on SPAD value. The findings of Naik *et al.* (2018) ^[16] in jackfruit, Rani *et al.* (2015) ^[17] in guava and Haricharan *et al.* (2021) in custard apple, similar with those of the present study.

Scion and rootstock girth (cm)

Maximum scion girth 0.64 cm and 0.70 cm at 30 and 60 DAG, respectively and rootstock girth 0.76 cm and 0.89 cm at 30 and 60 DAG, respectively, was noted in Arka Sahan. The performance of a scion is determined by its stionic compatibility with the rootstock and the perfection of the union. The changes might be attributed to early graft union healing, which effects the plant's rapid physiological growth and may have enhanced meristematic activity at the graft union, resulting an accumulation of stored metabolites at the graft union. The existence of endogenous gibberellin levels in the grafts may be responsible for the increased development of stock and scion, which drives greater cell division and cell enlargement. Gurudutta *et al.* (2004) ^[18] in mango, Ram *et al.* (2012) ^[19] in mango and Mayavel *et al.* (2022) ^[20] in tamarind studies is similar for scion and rootstock girth (cm).

Fresh and dry weight of shoots per graft (g)

Arka Sahan had a substantially higher maximum fresh and dry weight of shoot 18.36 g and 5.25 g. The maximum fresh weight of shoot in Arka Sahan. This might be attributed to the maximum scion height, number of leaves and leaf area resulting in a greater accumulation of glucose necessary for vegetative development of the plant and a higher shoot weight. Roshan *et al.* (2013) ^[21] in anola, Choudhary *et al.* (2016) ^[22] and Pawar *et al.* (2018) ^[7] in custard apple observed a similar result regarding the fresh weight of shoots in custard apple grafts.

Stionic ratio

Results of the present experiment revealed significant variations (0.79 to 0.82) with respect to stionic ratio among the grafts of different cultivars. The favorable stionic ratio (close to one) was recorded in graft of cultivars Saraswati-7 and Chandsili. Grafts of cultivars Saraswati-7 and Chandsili have a favorable stionic ratio (near to one). The favorable stionic ratio (nearly one) implies that the stock is more compatible with the scion. Better stock-scion compatibility promotes the fast movement of food material from the leaf to other plant elements such as the stem and roots. Roshan *et al.* (2013) ^[21] found a similar finding in anola and Pawar *et al.* (2018) ^[7] in custard apple.

Survival percentage (%) at 60 DAG

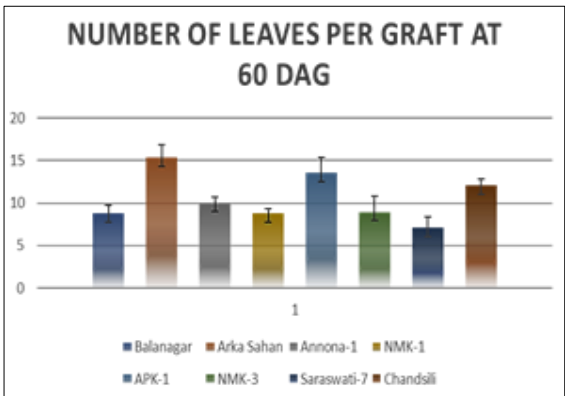
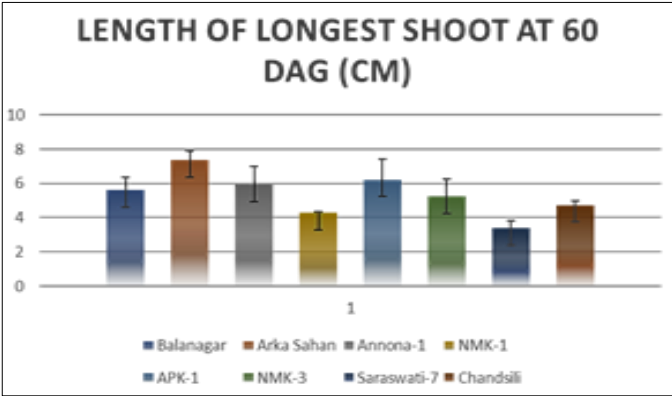
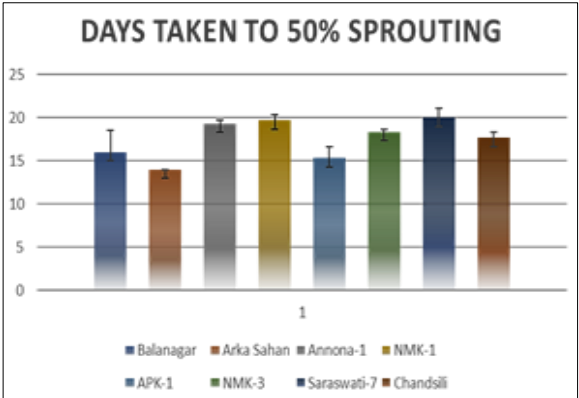
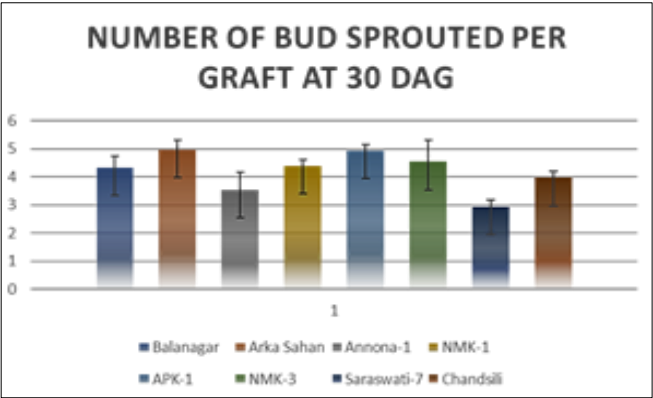
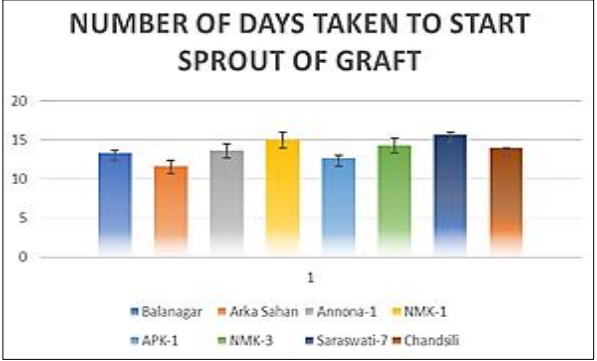
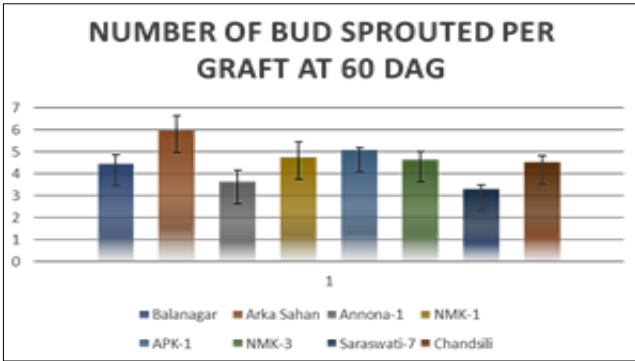
The percentage of grafts that survived indicated substantial differences across treatments. The success rate varied from 41.66 to 94.44 percent. Arka Sahan was recorded highest graft success percentage (94.44%). This could be due to faster callus formation at the grafted portion, resulting in faster healing of the graft combination due to faster developmental processes like cell division and cell elongation, resulting in the early emergence of leaves with more leaf area, which might have contributed to the production of a larger quantity of carbohydrates needed for the growth and development of grafts. Similar results are accordance with the findings of Joshi *et al.* (2000) ^[23], Kumar and Shukla (2012) ^[24] and pawar *et al.* (2018) in custard apple.

Conclusion

Based on the present results, it can be concluded that Arka Sahan is the overall best performing graft in terms of number of buds and shoots sprouted per graft, length of longest shoot, number of leaves, leaf area, SPAD value, scion and root stock girth, survival percentage, less stionic ratio and biomass characters like fresh and dry weight of shoot followed by Balanagar graft in Agro-climatic condition of malwa plateau. Arka Sahan is the best performing when grafted on local type rootstock of custard apple in agro-climatic condition of malwa plateau region

Table 2: Stionic ratio, scion girth and rootstock girth in different custard apple cultivars

Treatments	Stionic ratio	Scion girth (cm)		Rootstock girth (cm)	
		30 DAG	60 DAG	30 DAG	60 DAG
T ₁ -Balanagar	0.80	0.62	0.65	0.71	0.81
T ₂ -Arka Sahan	0.79	0.64	0.70	0.76	0.89
T ₃ - Annona-2	0.81	0.58	0.63	0.69	0.78
T ₄ - NMK-1	0.80	0.60	0.66	0.70	0.82
T ₅ - APK-1	0.82	0.63	0.69	0.74	0.85
T ₆ - NMK-3	0.80	0.59	0.67	0.73	0.84
T ₇ - Saraswati-7	0.82	0.52	0.61	0.67	0.74
T ₈ - Chandsili	0.82	0.57	0.62	0.68	0.76
SEm ±	0.01	0.02	0.01	0.01	0.02
C.D. (5%)	0.02	0.05	0.04	0.04	0.05



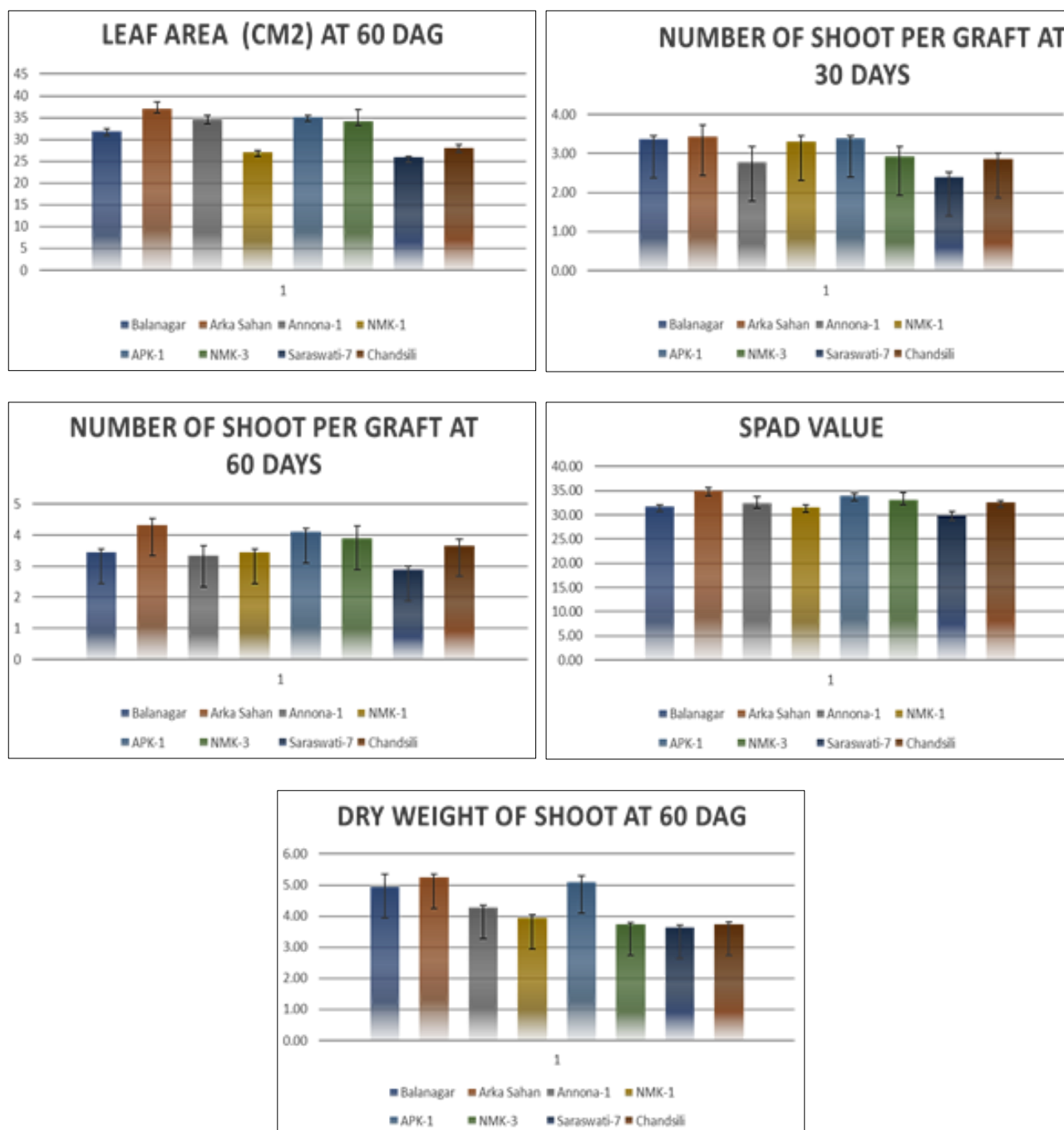


Fig 1: Number of days taken to start sprouting of graft, Days taken to 50% sprouting, Number of buds sprouted per graft at 30 and 60 DAG, Number of shoots per graft at 30 and 60 DAG in different Custard apple cultivars

Figure 1: Length of longest shoot (cm) at 60 DAG, Number of leaves per graft at 60 DAG, leaf Area (cm²) at 60 DAG, SPAD value at 60 DAG, Fresh weight of shoot per graft (g) at 60 DAG and Dry weight of shoot per graft (g) at 60 DAG in different Custard apple cultivars

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