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# Effect of chemicals on shoot growth and success of cuttings in fig (*Ficus carica* L.) Cv. Dinkar

**PA Dhawale, RV Nainwad, GR Munde and NB Wadhekar**

**Abstract**
The present investigation entitled "effect of chemicals on shoot growth and success of cuttings in fig (*Ficus carica* L.) Cv. Dinkar" was conducted at Department of Horticulture, College of Agriculture, Badnapur, Dist-Jalna, during 2014-15 with the object to study the effect of chemicals on success and survival of cuttings in fig. The experiment was laid out in Randomized Block Design (RBD) with sixteen treatments replicated twice. Among the chemical treatments in present investigation, maximum number of cuttings sprouted at 15 days (15.50), at 30 days (25.50) and at 45 days (30.00), number of shooted cuttings at 30 days (85.00%), at 60 days (100.00%) and at 90 days (100.00%), number of shoots per cutting at 30 days (1.18), at 60 days (2.05) and at 90 days (2.79), shoot diameter at 30 days (2.92 cm), at 60 days (3.79 cm), and at 90 days (4.88 cm), shoot length at 30 days (8.71 cm), at 60 (12.94 cm) and at 90 days (14.67 cm), number of leaves per cutting at 30 days (2.78), at 60 days (6.61) and at 90 days (9.53), leaf area at 30 days (179.50 $cm^2$), at 60 days (281.00 $cm^2$) and at 90 days (381.00 $cm^2$), fresh weight of shoot (39.55 g), dry weight of shoot (25.07 g) maximum percent success (100.00%)was noticed in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm). However, minimum number of cuttings sprouted at 15 days (4.50), at 30 days (12.50) and at 45 days (17.50), number of shooted cuttings at 30 (41.66%), at 60 days (58.33%) and at 90 days (58.33%), number of shoots per cutting at 30 (0.55), at 60 days (0.59) and at 90 days (0.66), shoot thickness or diameter at 30 days (0.43 cm), at 60 days (0.87 cm), and at 90 days (1.70 cm), shoot length at 30 days (1.98 cm), at 60 days (4.54 cm) and at 90 days (5.89 cm), number of leaves per cutting at 30 days (0.69), at 60 (0.71) and at 90 days (1.11), leaf area at 30 days (17.00 $cm^2$), at 60 days (25.00 $cm^2$) and at 90 days (50.50 $cm^2$), fresh weight of shoot (15.12 g), dry weight of shoot (8.29 g) minimum percent success of cuttings (58.33 %) was recorded in treatment $T_{16}$ (control).

**Keywords:** Fig, stem cutting, IBA, PHB, salicyclic acid and shoot growth

## Introduction
Fig (*Ficus carica* L.) is an important fruit crop grown as subtropical crop, especially in arid and semiarid regions of the world. Fig is a member of the *Moraceae* family. It is native to the tropical areas of eastern Asia. In India, its commercial production is limited to a few places near Pune and Aurangabad districts of Maharashtra, Bellary and Anantpur districts of Karnataka. Some of the cultivars grown in world are Black Ischia, Brown Turkey, Turkish White, Kabul, Marseilles and in India Puna fig, Daulatabad, Dinkar etc. varieties grown commercially. As far Maharashtra is concerned most of the area of the fig is under Daulatabad and Dinkar varieties. Fig is moderately important world crop with an estimated annual production of one million tons of fruit of which about 30 per cent is produced by Turkey. The commercial cultivation of common (edible) fig is mostly confined to western parts of Maharashtra. The total area under fig cultivation is reported to be 883 ha, with production of 2850 MT. (Anon, 2008) [1]. As fig is tolerant to saline and alkaline soil there is vast scope for extending its cultivation in such soil. It is generally propagated by air layering and tip cuttings. The plants propagated through air layering are less in quantity, require more skill and time. So the easiest and economic method is multiplication through cutting but the problem lies in very low or undesirable percentage of success. Fig is hard to root hence its cuttings develop roots with great difficulty. Plant growth regulators usually Auxin have an important role in stimulation and initiation of roots to cutting. Auxin induces root formation by breaking root apical dominance induced by cytokinin (Cline, M.G., 2000) [2]. Root promoting hormones play important role in the success of rooting of cuttings. Keeping in view the importance of propagation through cuttings very less research work has so far been done on propagation of fig by cuttings using plant growth regulator and chemicals. Therefore it is felt necessary to undertake the study on effect of chemicals on shoot growth and success of cuttings in fig (*Ficus carica* L.) Cv. Dinkar under Badnapur condition for quicker multiplication in nursery.

## Material and Methods

The experiment was conducted at Department of Horticulture, College of Agriculture, Badnapur during the year 2014-2015. The experiment was laid out in randomized block design with sixteen treatments replicated twice. The treatments are $T_1$ (IBA 1000 ppm), $T_2$ (IBA 1500 ppm), $T_3$ (IBA 2000 ppm), $T_4$ ($T_1$ + SA 2000 ppm), $T_5$ ($T_1$ + SA 2500 ppm), $T_6$ ($T_2$ + SA 2000 ppm), $T_7$ ($T_2$ + SA 2500 ppm), $T_8$ ($T_3$ + SA 2000 ppm), $T_9$ ($T_3$ + SA 2500 ppm), $T_{10}$ ($T_1$+ PHB 1500 ppm), $T_{11}$ ($T_1$ + PHB 2000 ppm), $T_{12}$ ($T_2$ + PHB 1500 ppm), $T_{13}$ ($T_2$ + PHB 2000 ppm), $T_{14}$ ($T_3$ + PHB 1500 ppm), $T_{15}$ ($T_3$ + PHB 2000 ppm), $T_{16}$ (Control).The experiment was carried out by planting the cuttings of fig in polythene bags of size (4`` × 6``). The polythene bags were punctured to improve the drainage and filled with garden mixture which was prepared by well mixing of one part of soil, one part of sand, one part of well rotted FYM (1:1:1 proportion of soil, sand and FYM). The cuttings of fig Cv. Dinkar fig used for this research were selected from 5 years old mother plant. Hardwood types of cutting were carefully selected. Pre-treated fig cuttings were planted in polythene bags which were properly filled, labeled with tags and placed as per layout. The cuttings of fig cv. Dinkar fig used for this research were selected from 5 years old mother plant. Hardwood cuttings from one year old shoots of 15-20 cm length and 1.5-2 cm in diameter having 4-5 nodes each were selected. Treatment wise solutions of IBA and other chemicals alone and in combination were prepared. The required quantities of chemicals were weighed on the chemical balance. The weighed quantity of chemical powder was dissolved in 5ml of ethyl alcohol (50%) then required quantity of distilled water was added to make the solutions of desired concentrations. The lower portion of cuttings (1-2 cm) will be treated with different concentration of chemicals by quick deep method for 5-10 seconds and allow to dry for 5 minutes in partial shed and then planted in poly bags containing soil + sand + FYM (1:1:1) in a such manner that the 1/3$^{rd}$ portion of the cutting insert in the media and light irrigation was applied gradually in the morning and evening with the help of water cane. Observations were recorded for days of sprouting, Number of shooted cuttings (%),Number of shoot per cutting, Shoot thickness or diameter (cm), Shoot length (cm), Number of leaves per cuttings, Leaf area (cm$^2$), Fresh weight of shoot (g), Dry weight of shoot (g), Percent success of cuttings (%). The data was analyzed statistically and presented as per methods suggested by Panse and Sukhatme (1985) [5].

## Results and Discussion

### Days to sprouting

Days to sprouting of fig cuttings influenced by various chemical treatments at 15, 30, 45 days after transplanting showed significant differences. At 15 DAT of cutting, maximum number of cuttings sprouted (15.50) was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm). However, it was at par with the treatment $T_{13,}$ ($T_2$ + PHB 2000 ppm) and $T_{14}$ ($T_3$ + PHB 1500 ppm) (15.00 and 14.50, respectively). It was followed by treatment $T_{15}$ (12.50) and $T_3$ (12.00). While other treatments $T_2$, $T_9$, $T_8$, $T_1$, $T_{11}$, $T_{10}$, $T_7$, $T_6$, $T_5$ and $T_4$ showed intermediate effect. While minimum number of cuttings sprouted (4.50) was reported in treatment $T_{16}$ (i.e. control). Almost similar trend was reported at 30 and 45 DAT of cutting where maximum number of cuttings sprouted (25.50 and 30.00) respectively was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm). While, minimum number of cuttings sprouted (12.50 and 17.50) respectively was reported in treatment $T_{16}$ (i.e. control).

### Number of shooted cuttings (%)

The data presented in Table 1 indicated that, numbers of shooted cuttings influenced by various chemical treatments. At 30 DAT of cutting maximum number of shooted cuttings (85.00%) was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm). It was followed by the treatment $T_3$ (81.66%), $T_{13}$ (80.00%), $T_{14}$ (76.66%), $T_1$ (76.66%), $T_2$ (76.66%) and $T_{15}$ (75.00%), which were at par with each other. Remaining treatments $T_9$, $T_8$, $T_{11}$, and $T_{10}$ showed intermediate effect. Significantly minimum number of shooted cuttings (41.66%) was reported in control. Almost similar trend was recorded at 60 and 90 DAT maximum number of shooted cuttings (100.00% and 100.00%) respectively was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm) and $T_{13}$ (100.00%). Significantly minimum number of shooted cuttings (58.33% and 58.33%) respectively was reported in control.

### Number of shoot per cuttings

The observation recorded in respect of numbers of shoot per cuttings indicated that at 30 DAT of cutting, maximum number of shoots per cutting (1.18) was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm). However, it was at par with the treatment $T_{13}$ (1.11) and $T_{14}$ (1.08). It was followed by treatment $T_{15}$ (1.03), $T_3$ (1.03), $T_2$ (1.01), $T_9$ (0.99), $T_1$ (0.98), $T_{11}$ (0.94) and $T_{10}$ (0.93). While all other treatments $T_7$, $T_8$, $T_6$, $T_5$ and $T_4$ showed intermediate effect. Significantly minimum numbers of shoots per cutting (0.55) were reported in control. Almost similar trend was recorded at 60 and 90 DAT of cutting, maximum number of shoots per cutting (2.05 and 2.79) respectively was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm). However, it was at par with the treatment $T_{13}$ (1.99 and 2.69). Significantly minimum number of shoots per cutting (0.59 and 0.66) respectively was reported in control.

**Table 1:** Effect of chemicals on shoot growth of cuttings in fig Cv. Dinkar

| Treatment number | Days to sprouting | | | Number of shooted cuttings (%) | | | Number of shoots per cuttings | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15 DAT | 30 DAT | 45 DAT | 30 DAT | 60 DAT | 90 DAT | 30 DAT | 60 DAT | 90 DAT |
| $T_1$ | 10.50 | 23.00 | 29.00 | 23.00 (76.66) | 29.00 (96.66) | 29.00 (96.66) | 0.98 | 1.79 | 2.43 |
| $T_2$ | 11.00 | 23.00 | 29.00 | 23.00 (76.66) | 29.00 (96.66) | 29.00 (96.66) | 1.01 | 1.78 | 2.48 |
| $T_3$ | 12.00 | 24.50 | 29.50 | 24.50 (81.66) | 29.50 (98.33) | 29.50 (98.33) | 1.03 | 1.86 | 2.59 |
| $T_4$ | 7.00 | 15.00 | 25.00 | 15.00 (50.00) | 25.00 (83.33) | 25.00 (83.33) | 0.78 | 1.38 | 1.98 |
| $T_5$ | 8.00 | 16.50 | 25.00 | 16.50 (55.00) | 25.00 (83.33) | 25.00 (83.33) | 0.83 | 1.48 | 2.16 |
| $T_6$ | 8.00 | 17.00 | 25.50 | 17.00 (56.66) | 25.50 (85.00) | 25.50 (85.00) | 0.84 | 1.46 | 2.18 |
| $T_7$ | 8.50 | 17.50 | 26.50 | 17.50 (58.33) | 26.50 (88.33) | 26.50 (88.33) | 0.88 | 1.59 | 2.19 |
| $T_8$ | 10.50 | 21.50 | 27.50 | 21.50 (71.66) | 27.50 (91.66) | 27.50 (91.66) | 0.84 | 1.59 | 2.33 |
| $T_9$ | 11.00 | 22.00 | 28.00 | 22.00 (73.33) | 28.00 (93.33) | 28.00 (93.33) | 0.99 | 1.89 | 2.39 |
| $T_{10}$ | 9.00 | 19.00 | 28.00 | 19.00 (63.33) | 28.00 (93.33) | 28.00 (93.33) | 0.93 | 1.64 | 2.31 |
| $T_{11}$ | 9.50 | 19.50 | 28.00 | 19.50 (65.00) | 28.00 (93.33) | 28.00 (93.33) | 0.94 | 1.68 | 2.29 |
| $T_{12}$ | 15.50 | 25.50 | 30.00 | 25.50 (85.00) | 30.00 (100.00) | 30.00 (100.00) | 1.18 | 2.05 | 2.79 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $T_{13}$ | 15.00 | 24.00 | 30.00 | 24.00 (80.00) | 30.00 (100.00) | 30.00 (100.00) | 1.11 | 1.99 | 2.69 |
| $T_{14}$ | 14.50 | 23.00 | 29.50 | 23.00 (76.66) | 29.50 (98.33) | 29.50 (98.33) | 1.08 | 1.96 | 2.68 |
| $T_{15}$ | 12.50 | 22.50 | 29.00 | 22.50 (75.00) | 29.00 (96.66) | 29.00 (96.66) | 1.03 | 1.96 | 2.68 |
| $T_{16}$ | 4.50 | 12.50 | 17.50 | 12.50 (41.66) | 17.50 (58.33) | 17.50 (58.33) | 0.55 | 0.59 | 0.66 |
| SE± | 0.31 | 0.82 | 0.81 | 1.25 | 1.36 | 1.36 | 0.04 | 0.03 | 0.04 |
| CD at 5 % | 1.02 | 2.39 | 2.49 | 3.30 | 3.44 | 3.44 | 0.13 | 0.14 | 0.14 |

(Figure in parenthesis is arsenic values)

**Shoot diameter (cm)**

The results obtained regarding shoot diameter revealed that, at 30 days of cutting maximum diameter of shoots per cutting (2.92 cm) was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm) which was superior over rest of the treatment. Next best treatment was $T_{13}$ (2.84 cm). It was followed by treatment $T_{14}$ (2.70 cm), $T_{15}$ (2.61 cm) and while other treatments, $T_1$, $T_9$, $T_8$, $T_{11}$, $T_{10}$, $T_7$, $T_6$, $T_5$, and $T_4$ showed intermediate effect. Significantly minimum diameter of shoots per cutting (0.43 cm) was reported in treatment $T_{16}$ (i.e. control). Almost similar trend was recorded at 60 and 90 DAT of cutting.

**Table 2:** Effect of chemicals on shoot growth of cuttings in fig Cv. Dinkar

| Treatment number | Shoot diameter (cm) | | | Shoot length (cm) | | | Number of leaves per cutting | | |
|---|---|---|---|---|---|---|---|---|---|
| | 30 DAT | 60 DAT | 90 DAT | 30 DAT | 60 DAT | 90 DAT | 30 DAT | 60 DAT | 90 DAT |
| $T_1$ | 1.82 | 2.48 | 3.78 | 6.20 | 10.38 | 12.26 | 2.08 | 5.18 | 7.85 |
| $T_2$ | 1.89 | 2.68 | 3.85 | 6.53 | 6.16 | 12.81 | 2.25 | 5.51 | 8.13 |
| $T_3$ | 1.94 | 2.84 | 3.91 | 7.13 | 10.97 | 13.05 | 2.46 | 5.93 | 8.74 |
| $T_4$ | 0.76 | 1.06 | 2.07 | 3.06 | 5.39 | 6.87 | 1.09 | 3.14 | 5.15 |
| $T_5$ | 0.84 | 1.23 | 2.28 | 4.12 | 6.19 | 8.17 | 1.26 | 3.50 | 5.83 |
| $T_6$ | 0.90 | 1.38 | 2.47 | 5.11 | 7.07 | 9.13 | 1.36 | 3.66 | 6.09 |
| $T_7$ | 0.96 | 1.58 | 2.62 | 5.37 | 7.27 | 9.51 | 1.56 | 3.74 | 6.56 |
| $T_8$ | 1.61 | 2.31 | 3.49 | 5.19 | 9.28 | 11.07 | 1.83 | 4.01 | 7.21 |
| $T_9$ | 1.70 | 2.38 | 3.65 | 5.40 | 9.60 | 11.52 | 2.01 | 4.76 | 7.51 |
| $T_{10}$ | 1.49 | 2.03 | 3.05 | 6.06 | 8.14 | 10.07 | 1.61 | 3.80 | 7.13 |
| $T_{11}$ | 1.54 | 2.17 | 3.26 | 6.48 | 8.35 | 10.33 | 1.63 | 3.91 | 7.11 |
| $T_{12}$ | 2.92 | 3.79 | 4.88 | 8.71 | 12.94 | 14.67 | 2.78 | 6.61 | 9.53 |
| $T_{13}$ | 2.84 | 3.62 | 4.67 | 8.33 | 12.17 | 14.22 | 2.66 | 6.43 | 9.29 |
| $T_{14}$ | 2.70 | 3.44 | 4.47 | 7.58 | 11.82 | 13.71 | 2.58 | 6.40 | 9.21 |
| $T_{15}$ | 2.61 | 3.11 | 4.17 | 7.37 | 11.48 | 13.17 | 2.56 | 6.29 | 9.14 |
| $T_{16}$ | 0.43 | 0.87 | 1.70 | 1.98 | 4.54 | 5.89 | 0.69 | 0.71 | 1.11 |
| SE± | 0.01 | 0.01 | 0.02 | 0.02 | 1.11 | 0.12 | 0.05 | 0.17 | 0.11 |
| CD at 5 % | 0.032 | 0.057 | 0.075 | 0.082 | 3.385 | 0.382 | 0.169 | 0.517 | 0.351 |

**Shoot length (cm)**

At 30 days of cutting, the significantly maximum length of shoots per cutting (8.71cm) was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm) over rest of the treatments. It was followed by treatments $T_{13}$ (8.33cm) and $T_{14}$ (7.58 cm). Next best treatment was $T_{15}$ (7.37 cm). While other treatments $T_3$, $T_2$, $T_{11}$, $T_1$, $T_{10}$, $T_9$, $T_7$, $T_8$, $T_6$, $T_5$, and $T_4$ showed intermediate effect. Significantly minimum length of shoots per cutting (1.98 cm) was reported in control. Almost similar trend was recorded at 60 and 90 DAT of cutting.

**Number of leaves per cuttings**

The data presented in Table 2 showed, at 30, 60 and 90 DAT of cutting maximum number of leaves per cutting (2.78, 6.61, 9.53 respectively) was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm) which was significantly superior over control (0.69, 0.71 and 1.11 respectively) .

**Table 3:** Effect of chemicals on leaf area, fresh weight of shoot, dry weight of shoot and success in fig Cv. Dinkar

| Treatment Number | Leaf area ($cm^2$) | | | Fresh weight of shoot (g) | Dry weight of shoot (g) | Percent success of cuttings (%) |
|---|---|---|---|---|---|---|
| | 30 DAT | 60 DAT | 90 DAT | | | |
| $T_1$ | 81.50 | 156.50 | 259.00 | 23.92 | 19.95 | 96.66 |
| $T_2$ | 97.50 | 167.50 | 272.50 | 25.37 | 21.91 | 96.66 |
| $T_3$ | 110.50 | 177.50 | 284.00 | 26.27 | 22.68 | 98.33 |
| $T_4$ | 23.00 | 33.00 | 115.00 | 16.46 | 9.86 | 83.33 |
| $T_5$ | 31.50 | 35.50 | 139.00 | 17.37 | 10.71 | 83.33 |
| $T_6$ | 39.50 | 44.00 | 158.00 | 17.74 | 12.00 | 84.99 |
| $T_7$ | 45.50 | 71.50 | 174.00 | 18.17 | 13.54 | 88.33 |
| $T_8$ | 64.50 | 122.50 | 227.50 | 22.15 | 18.00 | 91.66 |
| $T_9$ | 72.50 | 145.50 | 255.00 | 23.37 | 19.17 | 93.33 |
| $T_{10}$ | 51.50 | 95.00 | 200.50 | 18.78 | 15.00 | 93.33 |
| $T_{11}$ | 56.50 | 103.50 | 212.50 | 20.51 | 16.94 | 93.33 |
| $T_{12}$ | 179.50 | 281.00 | 381.00 | 39.55 | 25.07 | 100.00 |
| $T_{13}$ | 160.50 | 266.50 | 365.50 | 34.97 | 24.57 | 100.00 |
| $T_{14}$ | 146.50 | 246.50 | 348.50 | 30.24 | 23.89 | 98.33 |
| $T_{15}$ | 127.50 | 224.00 | 327.00 | 28.02 | 23.85 | 96.66 |
| $T_{16}$ | 17.00 | 25.00 | 50.50 | 15.12 | 8.29 | 58.33 |
| S.E± | 1.42 | 3.48 | 2.63 | 0.21 | 0.16 | 2.77 |
| C.D. at 5% | 4.29 | 10.45 | 7.90 | 0.68 | 0.49 | 8.30 |

**Leaf area ($cm^2$)**

The observations recorded in respect of leaf area indicated that, at 30 days of cutting, significantly maximum leaf area per cutting (179.50 $cm^2$) was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm) over rest of the treatments under study. It was followed by the treatment $T_{13}$ (160.50 $cm^2$) and $T_{14}$ (146.50 $cm^2$). While other treatments $T_{15}$, $T_3$, $T_2$, $T_1$, $T_9$, $T_8$, $T_{11}$, $T_{10}$, $T_7$, $T_6$, $T_5$, and $T_4$ showed intermediate effect. Significantly minimum leaf area per cutting (17.00 $cm^2$) was reported in control. Almost similar trend was recorded at 60 and 90 DAT of cutting.

**Fresh and dry weight of shoot (g)**

The data revealed that, treatment $T_{12}$ ($T_2$ + PHB 1500 ppm) produced more fresh and dry weight of shoot (39.55g and 25.07g respectively) which was significantly superior over control. Significantly less fresh and dry weight of shoot (15.12 g and 8.29 g respectively) was observed under treatment control.

**Percent success of cuttings (%)**

Perusal of data presented in Table (16) revealed that significantly maximum percent success (100.00%) was reported in treatment $T_{12}$ ($T_2$ + PHB 1500 ppm) and $T_{13}$ (100.00%) which was at par with each other. It was followed by treatment $T_{14}$ (98.33%), $T_3$ (98.33%), $T_2$ (96.66%), $T_{15}$ (96.66%), and $T_1$ (96.66%) which was statistically at par with each other. While, minimum percent success (58.33%) was reported in treatment control.

In present investigation, treatment $T_{12}$ ($T_2$ + PHB 1500 ppm) was superior in respect of days to sprouting, number of shooted cuttings, number of shoots per cutting, shoot thickness or diameter, shoot length, number of leaves per cutting, leaf area, fresh weight of shoot, dry weight of shoot.

This might have resulted from development of effective root system and increase in number and length of roots per cutting which might have influenced the uptake of nutrients and water. Similar results were reported by Ram *et al.* (2005) [6] in pomegranate and Kumar Sanjay *et al.* (2004) [4] in Sweet lime. Diwakar and Katiyar (2013) [3] have also reported similar results in kagzi lime and found that maximum percent of cutting sprouted, number of sprout per cutting, diameter of thickest sprout, number of leaves per cutting, length of leaf and width of leaf with the treatment IBA and PHB in combination.

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