Response of types of cuttings and IBA concentration on different sprouting of roots in Crossandra (*Crossandrainfundibuliformis L.*)

Abstract

The present investigation was conducted under Konkan Agro-climatic conditions at College of Horticulture, Dr. BalasahebSawantKonkanKrishi Vidyapeeth,Dapoli, Dist.Ratnagiri(India)during the kharif season(2023-2024). The experiment was laid out in Factorial Randomized Block Design (FRBD) with twelve treatment combinations and three replications. Present investigation found that in types of stem cuttings treatment C1:Softwood cuttings was found best with respect to minimum days to first sprout, days to highest sprouting , maximum number of new sprouts/cuttings, girth of sprout, length of new sprout, number of leaves, leaf area, survival(%), fresh weight of shoot, dry weight of shoot, absolute growth rate, relative growth rate, number of roots, length of longest root, fresh weight of root, dry weight of root, shoot to root ratio. In different IBA concentration treatment H_4 : IBA@2000ppmwas found best with respect to minimum days to first sprout, days to highest sprouting , maximum number of new sprouts/cuttings, girth of sprout, length of new sprout, number of leaves, leaf area, survival(%), fresh weight of shoot, dry weight of shoot, absolute growth rate, relative growth rate, number of roots, length of longest root, fresh weight of root, dry weight of root. In interaction effect treatment C_1H_4(Softwood cuttings treated with IBA@2000 ppm) is found to be most effective among all other treatment combinations in terms of most of the parameters such as Sprouting percentage, Number of new sprouts/cuttings, Length of sprout/cuttings, Girth of new sprout, Number of leaves/cuttings, Leaf area, Survival percentage, Fresh weight of shoot, Relative Growth Rate, Fresh weight to dry weight of shoot ratio, Number of roots.

Keywords: Crossandra,*Crossandrainfundibuliformis*, stem cutting, IBA, Survival

Introduction

Crossandra*(Crossandrainfundibuliformis* L.) belongs to the family Acanthaceae. It's also known as "Fire cracker plant," "Tropical flame," or "Kanakambaram." The flowers are offered to the gods of the temple and are usually used as loose flowers to decorate hair and to make garlands, gajras, and venis. In Tamil Nadu, Andhra Pradesh, and Karnataka, crossandra is grown forcommercial purposes as a loose flowercrop. Commercially grown from seeds. Nonetheless, commercial triploid cultivars like Delhi Crossandra, ArkaShreeya, and ArkaShravya are excellent keepers, producing blooms all year round regardless of the season. There is no seed set by these cultivars. So, there is a great demand from farmers for planting material of the above-mentioned varieties. Thus, production of planting material in bulk through vegetative propagation by using cuttings is peremptory to meet the great demand of planting material of Crossandra.

Material and methods

The present research work was carried out during *Kharif* season (2023-24)at Hi-Tech Nursery of College of Horticulture, Dapoli, Dist. Ratnagiri, (India). The experiment was laid out in Factorial Randomized Bock Design replicated thrice comprised of two factors types of stem cutting (Factor A) as C_1 (softwood cutting), C_2 (semi-hardwood cutting) and C_3 (hardwood cutting) and IBA(Indole Butyric Acid) levels (Factor B) as H_1 (control), H_2 (IBA @ 1000 ppm), H_3 (IBA @ 1500 ppm), and H_4 (IBA @ 2000 ppm)and twelve combinationsviz, C1H1 (softwood cuttings + control), C1H2 (softwood cuttings + IBA @1000 ppm), C1H3 (softwood cuttings + IBA @1500 ppm), C1H4 (softwood cuttings + IBA@ 2000 ppm), C2H1 (semi hardwood cuttings +control), C2H2 (semi hardwood cuttings + IBA@ 1000 ppm), C2H3 (semi hardwood cuttings + IBA@ 1500 ppm), C2H4 (semi hardwood cuttings + IBA@ 2000 ppm), C3H1 (hardwood cuttings + control), C3H2 (hardwood cuttings + IBA@ 1000 ppm), C3H3 (hardwood cuttings + IBA@ 1500 ppm) and C3H4 (hardwood cuttings + IBA@ 2000 ppm). Types of stem cutting like softwood, semi-hardwood and hardwood having 3-4 nodes and 12-15 cm length per cutting were taken from a healthy, vigorous and mature plant from local area. A slanting cut was given at the basal end of cuttings and transverse cut at the top of each cutting. Planted cuttings were treated with 1 per cent Bavistin followed by basal portion of about 2 cm length with last node was dipped in their respective IBA concentrations for 10 minutes and then planted in polythene bags (4”×6”) filled with mixing soil and vermicompost (3:1)**.** Stock solution was prepared by weighing and dissolving in 20 ml of Ethyl alcohol after getting well dissolved and transparent solution, volume was made up 1 L by adding distilled water. pH was adjusted as neutral. For control treatments, cuttings are directly planted in polythene bag media without any IBA treatment. After planting, the soil at the base was pressed fimly and light irrigation was given immediately with the help of rose water can. Daily observation was noted for sprouting parameters whereas survival percentage was recorded at the end of the experiment (90 DAP). The data were analyzed by standard method of analysis of variance described by Panse and Sukhatme (1985) [7].

Results and discussion

Days taken for first sprout and days required for highest sprouting

The data gathered on days taken for first sprout and days required for highest sprouting as influenced by different stem cutting and IBA concentrations are presented in Table 1.

Types of stem cutting (C)

The data revealed that the days taken for first sprout and days required for highest sprouting significantly influenced by types of stem cuttings. The types of stem cuttings had a significant effect on days taken to first sprout. Significantly, lowest days to first sprout (8.42) were recorded in treatment C_1 (softwood cuttings) and highest days to first sprout (11.33) recorded in treatment C_3 (hardwood cuttings).

Similarily, minimum days to highest sprout (22.42) were recorded in C_1 treatment (softwood cuttings) and maximum days to first sprout (30.25) recorded in C_3 treatment (hardwood cuttings).

The wood's maturation level and the current climatic conditions may be the cause of the variation in the number of days taken for first sprout and days required for highest sprouting. Compared to hardwood cuttings, softwood cuttings have more active meristematic cells and more endogenous auxin extracted from fresh flushes with stronger hormonal activity, which split the cells quickly and may be the cause of early sprout appearance. The findings were in agreement withSahariya*et al*. (2013)[9] in Bougainvillea, Ashok and Ravivarman (2021)[2] in *Lagerstroemia indica* L and Malaviya*et al*. (2022)[4] in Croton.

Indole Butyric Acid (IBA) concentrations (H)

The levels of IBA concentrations had significant effect on days to first sprout. The lowest number of days to first sprout (9.00) were recorded in H_4 (IBA@2000 ppm) while highest days to first sprout (10.33) were recorded in H_1 (control).

Similarily,the lowest number of days to highest sprout (23.89) were recorded in H_4 (IBA@2000 ppm) which is followed by treatment H_3 (IBA @ 1500 ppm), while highest days to highest sprout (28.67) were recorded in H_1 (control).

The sprouting of cuttings treated with IBA have resulted from the stimulation of hydrolysis of nutrient reserves and their mobilization. Sprouting in control is due to the already stored carbohydrates in the cuttings. Differences in sprouting may be due different levels of auxins.The highest number of sprouted buds per cutting was noted in 2000 ppm IBA. It may be due to auxin which enhance the formation of callus and differentiation of vascular tissue. This finding agrees with Singh *et al.* (2013)[11] in Thuja.Nanda *et al.* (1975)[5] confirmed that the use of auxin resulted to the breakdown of starch into soluble sugars and was used to produce new sprouts.Pain and Roy (1981)[6] reported considerable sprouting gains due to the use of IBA and other chemicals in *Dalbergiasisoo.*

Interaction effect (C×H)

The interaction effect between types of stem cutting and IBA levels on days taken for first sprout was found non significant whereas days required for highest sprouting on Crossandra was found significant. The lowest numbers of days to first sprout (7.33) was noted in C_1H_4 (Softwood cutting + IBA @ 2000ppm) followed by C_1H_3 (Softwood cutting + IBA @ 1500ppm) (8.33) and highest days was noted in C_3H_1 (Hardwood cutting + control condition). In the case of highest sprouting,lowest numbers of days to highest sprout (16.67 and 22.00 respectively) was noted in C_1H_4 (Softwood cutting + IBA @ 2000ppm) and highest days (32.00) was noted in C_3H_1 (Hardwood cutting + control condition). Cells developed at base of cutting are more sensible to the treatment applied to cuttings have higher sensitivity improve water uptake leads to early sprout. Accumulation of endogenous auxin at the base of softwood cutting when treated with suitable concentration of exogenous auxin gave rise to hydrolysis of carbohydrates converted into simple sugar which might be results in early sprout emergence.

Survival percentage and Number of Roots

The data relevant to the effect of types of stem cutting and IBA concentrations on number of roots and survival percentage of Crossandra are presented in Table 2.

Types of stem cutting (C)

The effect of types of cuttings had significant effect on survival percentage at final stage. The highest survival percentage (82.83) was recorded in C_1 (Softwood cuttings) and lowest survival percentage (22.83) in C_3 (Hardwood cutting). However, types of cuttings used significantly influenced survival percentage.

It is noted that early sprouting observed higher survival percentage. Treatment C_1 showed minimum days to sprout hence showed highest survival percentage. The increased survival percentage in softwood cuttings may be due to the active development of root and shoot parameters which were poor in hardwood cuttings. Similar results were observed by Pooja (2010)[8] in *Lonicera japonica* (Japanese honey suckle) and Shenoy (1992)[10] in *Rosa damascena* (damask rose).

The different types of cuttings exhibited significant variations in number of roots where C_1 (Softwood cuttings) had recorded highest number of roots (19.00) which was at par with C_2 (Semi-hardwood cuttings) (17.67) whereas lowest number of roots (14.75) recorded in C_3 (Hardwood cutting).

The failure of rooting in hardwood cuttings may be due to the development of more number of vegetative shoots at initial stages, which might have caused reduced callus formation and root initiation.

IBA concentrations (H)

The influence of different level of IBA concentration recorded significant variation in survival percentage at final stage. Maximum survival percentage (60.67) were registered in H_4 (IBA @ 2000 ppm) which was at par with H_3 (IBA @ 1500 ppm) (56.22) while minimum survival percentage (48.89) was observed in H_1 (Control condition).

Maximum percentage of survival as a result of the IBA's enhancement of long roots, which grew each plant's leaf count gradually. Enough food is produced by photosynthates and nutrient absorption to support the plants' metabolic processes. These findings support the findings of Ahmad et al. (2002)[1], who said that the Bougainvillea cuttings exhibited the highest survival percentage when treated with IBA. Due to the fact that root cells are more sensitive and have an inhibitory impact on synthetic auxin, root cutting yields good results at 0% IBA. These root cutting results are also consistent with the findings of Campagnolo and Rafael (2007)[3], who determined that blackberry root cuttings had the greatest survival rate.

Among the various levels of IBA concentration H_4 (IBA @ 2000 ppm) recorded at maximum number of roots (19.78) while minimum number of roots (15.56) was observed in H_1 (Control condition).

Interaction effect (C×H)

The interaction effect of types of cuttings and IBA concentration was found non significant in all stages of growth with respect to survival percentage. The results revealed that maximum survival percentage (90.00) were recorded in C_1H_1 (Softwood cutting + control) and minimum (14.67) in C_3H_1 (Hardwood cutting + control) combination at final stage.

In parallel, the interaction study between types of cuttings and IBA concentration was non significant revealed that maximum number of roots (21.33) was noted in treatment combination C_1T_4(Softwood cutting + IBA@2000ppm) and minimum number of roots (13.00) in C_3H_1(hardwood cutting + control condition) in Crossandra.

Table 1: Effect of different stem cutting and IBA levels on days taken for first sprout and days required for higher sprouting of Crossandra.

Types of stem cutting	Days taken for first sprout					Days required for highest sprout				
	Levels of IBA concentration				Mean	Levels of IBA concentration				Mean
	H_1	H_2	H_3	H_4		H_1	H_2	H_3	H_4	
C_1	9.33	8.67	8.33	7.13	**8.42**	26.00	25.00	22.00	16.67	**22.42**
C_2	9.67	9.67	9.33	9.00	**9.42**	28.00	27.00	26.33	26.00	**26.83**
C_3	12.00	11.33	11.33	10.67	**11.33**	32.00	31.00	29.00	29.00	**30.25**
Mean	**10.33**	**9.89**	**9.67**	**9.00**	**9.72**	**28.67**	**27.67**	25.78	23.89	**26.50**
	S.Em. ±		**C.D. at 5%**		**Result**	**S.Em. ±**	**C.D. at 5%**		**Result**	
C	0.246		0.721		**SIG**	0.455	1.335		**SIG**	
H	0.284		0.832		**SIG**	0.525	1.541		**SIG**	
C × H	0.492				**NS**	0.910	2.669		**SIG**	

Table 2: Effect of different stem cutting and IBA levels on Number of Roots and survival (%) of Crossandra.

* The figure in parenthesis indicates arcsine transformed values *Days after planting

Types of stem cutting	Survival %					Number of Roots				
	Levels of IBA concentration				Mean	Levels of IBA concentration				Mean
	H_1	H_2	H_3	H_4		H_1	H_2	H_3	H_4	
C_1	75.33	81.33	84.67	90.00	**82.83**	17.33	18.00	19.33	21.33	**19.00**
C_2	56.67	54.67	60.00	62.00	**58.33**	16.33	16.33	16.67	21.33	**17.67**
C_3	14.67	22.67	24.00	30.00	**22.83**	13.00	13.67	15.67	16.67	**14.75**
Mean	**48.89**	**52.89**	**9.67**	**60.67**	**54.67**	**15.56**	**16.00**	**17.22**	**19.78**	**17.14**
	S.Em. ±		**C.D. at 5%**		**Result**	**S.Em. ±**	**C.D. at 5%**		**Result**	
C	1.340		3.930		**SIG**	0.635	1.862		**SIG**	
H	1.547		4.538		**SIG**	0.733	2.150		**SIG**	
C × H	2.680				**NS**	1.270			**NS**	

Factor A: Types of stem cutting	**Factor B: Levels of IBA concentration**	
C_1- Softwood	H_1 - Control	H_4 - 2000 ppm
C_2- Semi-hardwood	H_2 - 1000 ppm	
C_3- Hardwood	H_3 - 1500 ppm	

Conclusion

From the present investigation it could be inferred that softwood cuttings treated with 2000 ppm of IBA proved to be superior treatment combination for most of the parameters such as Number of new sprouts/cuttings, Length of sprout/cuttings, Girth of new sprout, Number of leaves/cuttings, Leaf area, Survival percentage, Fresh weight of shoot, Relative Growth Rate, Fresh weight to dry weight of shoot ratio, Number of roots under Konkan Agro-climatic conditions.

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