Madras Agric. J. 90 (7-9) : 511-514 July-September 2003

Effect of media and auxins of *in vitro* rooting in gerbera

S.BALAKRISHNAMOORTHY, L. JEEVA JOTHI AND R. MURUGESAN
Horticultural Research Station, Yercaud - 636 602, Tamil Nadu

Abstract: **In India, one of the major constraints faced by the floriculture industry is the non-availability of quality planting materials of improved cultivars. Micro-propagation assures rapid rate of multiplication of 'true to type' genetically stable plantlets. An experiment was conducted at Horticultural Research Station, Yercaud to study the effect of media and auxins on in vitro rooting of plantlets. The in vitro derived plantlets of gerbera cv. YCD.1 were cultured in two media *viz.* ½ MS and MS supplemented with the auxins IAA, IBA and NAA each at 3.5, 4.0, 4.5 and 5.0 mgl^{-1}. Addition of IBA at 4.5 mgl^{-1} induced rooting at the earliest (22.6 days) while, it was highly delayed by the addition of NAA 3.5 mgl^{-1} (46.5 days). Rooting hormone IAA produced the highest number of roots. The roots produced in the medium with NAA were swollen.**

Key words : Gerbera, micropropagation, rooting, auxins, IAA, IBA, NAA, MS and half MS media.

Introduction

An efficient rooting treatment yields a high percentage of rooted shoots and a good quality rooting system. Quality of the rooting system is determined by the number of roots per shoot, length of roots and the absence of callus formation which promise a good establishment of plantlets in soil (Mohammed and Vidaver, 1990). Auxins differ in their physiological activity and the extent to which they move within tissues or metabolised. In micropropagation, the induction of roots *in vitro'* is normally done with auxins *viz.* AA, IBA and NAA. The effect of these auxins often differs with gentoypes, media and the concentration used.

Materials and Methods

In order to evaluate the action of auxins *viz.* IAA, NAA and IBA on the rooting of gerbera shoots *'in vitro'*, an experiment was carried out at Horticultural Research Station, Yercaud for two years from 1998 to 2000. The *in vitro* derived plantlets of gerbera Cv. YCD.1 were cultured in two media *viz.* half MS and MS supplemented with auxins *viz.* IAA, NAA and IBA each at 3.5, 4.0, 4.5 and 5.0 mg l^{-1} concentrations. Ten explants were sub cultured and replicated thrice for each treatment. The cultures were maintained in a culture room with 14:20 hours of light and dark cycle.

Observations on the percentage of rooting and the number of primary roots per explant were recorded 40 days after subculturing. The days taken for root initiation was recorded as and when it appeared.

Results and Discussion

The influence of media and growth regulators on the percentage of rooting, days to root initiation and number of roots per explant in gerbera Cv. YCD.1 is presented in Tables 1,2 and 3 respectively.

Influence of media

Between the two media, the mean higher percentage of rooting (89.38) was obtained in ½ MS medium than MS medium, which registered 81.69 per cent rooting. In half MS medium, the days taken for root initiation ranged from 20.4 to 46.8 and in MS medium it ranged from 24.8 to 49.4. Between the two media, in half MS medium, the mean number of days taken for root initiation was the least (30.6 days) than MS medium (33.9). The number of roots per explant ranged from 5.8 to 12.8 in half MS medium and 4.6 to 11.2 in MS medium. Between the two media, half MS medium produced greater number of roots (10.2) than MS medium (8.7).

Root growth is often depressed by NH_4^+ and promoted by NO_3^- (George, 1993). MS

Table 1. Effect of media and growth regulators on the percentage of rooting in gerbera cv. YCD.1

Concentrations of growth regulators mg l^{-1}	Percentage of rooting		
	Half MS	MS	Mean
IAA 3.5	92.00 (76.95)	86.00 (68.32)	89.00 (72.63)
IAA 4.0	96.00 (82.08)	94.00 78.58)	95.00 (80.33)
IAA 4.5	100.00 (89.10)	98.00 85.59)	99.00 (87.34)
IAA 5.0	100.00 (89.10)	100.00 89.10)	100.00 (89.10)
NAA 3.5	70.00 (57.04)	52.00 46.10)	61.00 (51.60)
NAA 4.0	76.00 (60.78)	60.00 50.87)	68.00 (55.82)
NAA 4.5	86.00 (68.32)	66.00 54.38)	76.00 (61.35)
NAA 5.0	94.00 (78.58)	74.00 (59.45)	84.00 (69.01)
IBA 3.5	96.00 (82.09)	94.00 (78.58)	95.00 (80.33)
IBA 4.0	100.00 (89.10)	98.00 (85.59)	99.00 (87.34)
IBA 4.5	100.00 (89.10)	100.00 (89.10)	100.00 (89.10)
IBA 5.0	100.00 (89.10)	100.00 (89.100	100.00 (89.10)
Control	52.00 (46.10)	40.00 (39.10)	46.00 (42.64)
Mean	89.38 (76.73)	81.69 (70.30)	
	SEd	CD (0.05)	CD (0.01)
M	2.70	5.36	7.09
G	1.06	2.10	2.78
M x G	3.83	7.59	10.04

medium contained 1650 mg l^{-1} of $NH_4NO_3^-$ whereas half MS medium contained only half of it. The 50 per cent reduction in half MS medium and ratio of NH_4^+ and NO_3^- might have played an important role in the formation of earlier rooting and increased roots in the present study. Further, media of small osmotic potential are usually employed for the induction and growth of roots on micropropagated shoots. When high salt levels were used in stage II of shoot cultures, it is common to select a low salt medium (*eg.* ¼ or ½ MS), when rooting of detached shoots was required at stage III. In accordance with the results of the present

Table 2. Effect of media and growth regulators on the days taken to root initiation in gerbera cv. YCD.1

Concentrations of growth regulators mg l^{-1}	Days taken to root initiation		
	Half MS	MS	Mean
IAA 3.5	32.2	36.8	34.5
IAA 4.0	28.0	32.2	30.1
IAA 4.5	25.2	27.6	26.4
IAA 5.0	22.6	25.8	24.2
NAA 3.5	44.4	48.6	46.5
NAA 4.0	38.2	43.4	40.8
NAA 4.5	33.0	36.0	34.5
NAA 5.0	34.2	32.2	33.2
IBA 3.5	28.2	31.8	30.0
IBA 4.0	23.6	27.4	25.5
IBA 4.5	20.4	24.8	22.6
IBA 5.0	21.6	25.2	23.4
Control	46.8	49.4	48.1
Mean	30.6	33.9	
	SEd	CD (0.05)	CD (0.01)
M	0.8	1.6	2.1
G	0.3	0.6	0.8
M x G	1.1	2.2	3.0

Table 3. Effect of media and growth regulators on the number of roots per explant of gerbera cv. YCD.1

Concentrations of growth regulators mg l^{-1}	Number of roots per explant		
	Half MS	MS	Mean
IAA 3.5	10.4	8.8	9.6
IAA 4.0	11.8	9.6	10.7
IAA 4.5	12.0	10.8	11.4
IAA 5.0	12.8	11.2	12.0
NAA 3.5	7.4	5.4	6.4
NAA 4.0	8.8	7.4	8.1
NAA 4.5	9.6	8.4	9.0
NAA 5.0	9.8	8.6	9.2
IBA 3.5	9.8	8.6	9.2
IBA 4.0	10.6	9.4	10.0
IBA 4.5	12.2	10.2	11.2
IBA 5.0	11.4	9.8	11.6
Control	5.8	4.6	5.2
Mean	10.2	8.7	
	SEd	CD (0.05)	CD (0.01)
M	0.3	0.7	1.0
G	0.2	0.3	0.4
M x G	0.5	1.0	1.4

study, Pasoda *et al.* (1997) reported success with ½ MS medium.

Influence of auxins

Among the auxins, IAA at 5.0 mg l^{-1} and IBA at 4.5 and 5.0 mg l^{-1} recorded cent percent rooting followed by IAA 4.5 mgl^{-1} and IBA 4.0 mg l^{-1}, which recorded 99.00 per cent rooting. The lowest percentage of rooting was recorded in untreated control (46.00). The days taken for root initiation ranged from 24.2 to 34.5 in IAA, 33.2 to 46.5 in NAA and 23.4 to 30.0 in IBA while it was highly delayed (48.1) in the untreated control. The earliest root initiation occurred in IBA a 4.5 mgl^{-1} (22.6 days) followed by IBA 5.0 mgl^{-1} (23.4 days). Rooting was highly delayed in NAA 3.5 mg l^{-1} (46.5 days). Presence of more stable NAA in the tissues without enzymatic degradation might have inhibited the process of rooting. Similar to the results of the present study, Mariska (1989) also reported that IAA produced more number of roots while NAA produced only swollen roots.

The quick rooting and production of number of roots in gerbera might be due to the quick absorbance of IAA and IBA than NAA and quicker enzymatic degradation in the plant tissues. Among the auxins, IAA and IBA are not stable when compared to NAA. IBA is more stable than IAA, 75 per cent remained after 30 days in the dark, and 40 per cent remained after 30 days in the light. This particular characteristic of IBA might have helped to perform better than IAA (Nissen and Sucutter, 1988 and Epstein and Ludwig - Mullar, 1993).

Several workers studied the influence of auxins on the number of roots produced. Meyer and Van Staden (1987) reported success with 10.0 µM IBA than with 5.0 to 10.0 µM NAA. The number of roots per explant range from 9.6 to 12.0 in IAA, 6.4 to 9.2 in NAA and 9.2 to 11.6 in IBA. Among the auxins, IAA 5.0 mg l^{-1} recorded the mean highest number of roots (12.0) followed by IBA (11.6). The lowest number of roots (5.2) was recorded in the untreated control.

The interaction between the media and auxins indicated that cent per cent rooting was recorded in half MS medium supplemented with IAA 4.5 and 5.0 mg l^{-1} and IBA at 4.0, 4.5 and 5.0 mg l^{-1} and in MS medium supplemented with IAA 5.0 mg l^{-1} and IBA at 4.5 and 5.0 mg l^{-1}. half MS medium supplemented with IBA 4.5 and 5.0 mg l^{-1} initiated roots at the earliest (20.4 and 21.6 respectively). half MS medium supplemented with IAA 5.0 mg l^{-1} recorded the highest number of roots (12.8) while the untreated control registered the least number of roots (4.6) in MS medium.

Conclusions

In the present study, rhizogenesis was induced *'in vitro'* with the addition of a high proportion of auxin in the medium with the commonly used auxins *viz.* IAA, IBA and NAA. The shoots cultured in ½ MS medium rooted earlier 30.6 days) than those in MS medium (33.9 days). Besides this, higher percentage of rooting was observed in ½ MS medium than MS medium.

Among the auxins, IAA and IBA gave higher percentage of rooting when compared to NAA. Cent per cent rooting coupled with the earliest induction of roots and the highest number of roots were recorded in half MS medium supplemented with 4.5 and 5.0 mg l^{-1} of IBA as well as 5.0 mg l^{-1} of IAA.

References

Epstein, E. and Ludwig-Muller, J. (1993). Indole-3-butryic acid in plants: occurrence. *Physiol. Plant*, **88**: 382-389.

George, E.F. (1993). Plant propagation by tissue culture. Exegetics Ltd., Basingtoke, England.

Mariska, I., Gati, E. and Sukmabjaja (1989) In vitro clonal propagation of gerbera. *Bulletin Penelitiate Hortikultural*, **17**: 34-43.

Meyer, H.J. and Van Staden, J. (1988). The *in vitro* culture of *Gerbera aurantiaca*. *Plant Cell Tiss. Organ. Cult.* **14**: 25-30.

Mohammed, G.H. and Vidaver, W.E. (1988). Root production and plantlet development in tissue cultured conifers. *Plant Cell Tiss. Organ Cult.* **14**: 137-160.

Nissen, S.J. and Sucutter, E.G. (1988). Stability of IAA and IBA in nutrient medium after autoclaving and after storage under various environmental conditions. *Hort. Sci.* **23**: 758.

Pasoda, M., Ballesteros, W., Obando and Angarita, A. (1997). Micropropagation of gerberas from floral buds. *Acta Hort.* **482**: 329-332.

(Received: July 2002; Revised: July 2003)