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GROWTH AND PRODUCTIVITY OF PERIWINKLE (*CATHARANTHUS ROSEUS* (L.) G. DON) IN RELATION TO PLANT TYPE AND METHOD OF PROPAGATION

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Periwinkle (*Catharanthus roseus* (L) G. Don) has recently come into prominance as a medicinal plant of great value. Its foliage contains VLB alkaloids used in cancer therapy whereas its roots contain substances useful in controlling hypertension conditions. The crop is grown in an area of about 3000 ha in India using a mixed stand of both pink and white flowered ones. There is no information on the comparative performance of pink and white types. The crop can be propagated by seeds as well as cutting. An evaluation of method of propagation on growth and productivity is of practical importance in selecting the best method of propagation. Bugar and Sarkany (1973) reported that plants propagated from cuttings flowered 3-4 months earlier than from seed. They further advocated that for dry matter production, the plants should be propagated from seed and for seed production from cuttings. The present studies were carried out to assess the relative growth and productivity of pink and white flowered types of periwinkle propagated through seeds and cuttings.

Materials and Methods

The field experiments were conducted at the Indian Institute of Horticultural Research, Hessaraghatta, Bangalore, during 1980-81 and 1981-82 under protective irrigation on sandy loam soils of low fertility. There are four treatment combinations of two plant types (pink and white) and two methods of propagation (seed and cutting). Factorial randomised block design was adopted with six replications. Terminal stem cuttings of 10-12 cm length planted in pots were kept in mist-chamber for rooting. At the same time, seeds were sown in nursery for raising seedlings. Forty five day old seedlings and rooted cuttings were transplanted with a spacing of 60 cm x 30cm during first week of May during both the years. A uniform dose of 120 kg N, 60 kg P_2O_5 and 60 kg K_2O per ha was used for the crop. Half of N and all P_2O_5 and K_2O were applied at the time of transplanting and the remaining half nitrogen was topdressed 60 days later. The crop was harvested after 300 days by uprooting the entire plant carefully and separated into roots, leaves and stem and their dry weights recorded.

A sample of three random plants from each plot was uprooted at 60, 90, 120, 150, 180, 210, 240, 270 and 300 days after transplanting and separated into roots, leaves, stem and reproductive parts (flowers + follicles) and dry weights recorded. Leaf area was recorded following the method developed by Hedge (1983)

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and from this leaf area index (LAI) was calculated. From these basic data, net assimilation rate (NAR), crop growth rate (CGR) and relative growth rate (RGR) were computed following Watson (1952). NAR. CGR and RGR were caculated at each of the stages and only the mean values are presented here. Observations on plant height, branches per plant and stem diameter were recorded on 10 plants just before harvest.

Results and Discussion

The total dry matter production in periwinkle was slightly higher during 1981-82 than during 1980-81 as a spell of continuous rains during September, 1980 affected the growth adversely due to excess soil moisture (Fig. 1 and 2). In general, the dry matter production was slow in early stages until about 90 days from transplanting and thereafter it was rapid upto 210 to 240 days. However, it continued to increase upto 270 days and later decreased due to loss of leaves and follicles giving rise to sigmoid pattern to the dry matter production curve. The highest rate, of dry matter production was observed between 150 and 210 days after transplanting. As regards the distribution of dry matter into different parts, root and stem dry matter continuously increased upto harvest, while that in leaves and reproductive parts increased to reach the peak at 210 days after transplanting and later declined.

Effect of plant type

There were significant differences in growth and productivity of pink and white types of periwinkle during both the years. The total dry matter production and its distribution into different parts was significantly higher in pink type than in white type at all the stages during both the years except at 60 days after transplanting. At 300 days, pink type accumulated about 15 per cent more dry matter than white type. The higher dry matter production was probably a consequence of higher LAI in pink type at most of the stages which provided more photosynthetic surface for dry matter production (Table 1).

The mean NAR of pink type was significantly higher than white type (Table 2). NAR quantifies the gross efficiency of leaf canopies in elaborating plant dry matter from primary constituents in the root and aerial environment. It is clear from the present studies that photosynthetic efficiency of leaves in pink type was substantially higher than in white type which must have contributed to higher dry matter production. The mean CGR was also significantly higher in pink type during both the years (Table 2). However, the mean RGR did not differ significantly although pink type had slightly higher value than white type.

Growth parameters like plant height, branches per plant and stem diameter were not significantly affected by plant type (Table 3). However, conspicuous differences in root, leaf and stem yields were noticed between pink and white types

Table 1

Leaf area index (LAI) of periwinkle as affected by plant type and method of propagation

Treatments	Days after transplanting								
	60	90	120	150	180	210	240	270	300
				1980-81					
Plant type									
Pink	0.04	0.22	0.48	1.04	1.53	2.07	1.62	1.49	1.20
White	0.06	0.18	0.48	0.97	1.64	2.07	1.67	1.45	1.14
F test	Sig,	Sig.	NS	NS	Sig.	NS	NS	NS	NS
Method of propogation									
Seed	0.05	0.20	0.47	1.01	1.56	1.95	1.59	1.41	1.16
Cutting	0.05	0.20	0.49	1.00	1.61	2.19	1.70	1.43	1.11
F test	NS	NS	NS	NS	NS	Sig.	NS	NS	NS
SEm±	0.01	0.001	0.03	0.03	0.03	0.05	0.05	0.04	0.04
CD (0.05)	0.03	0.004	NS	NS	0.09	0.15	NS	NS	NS
				1981-82					
Plant type									
Pink	0.05	0.28	0.58	1.18	1.94	2.36	1.90	1.62	1.46
White	0.06	0.20	0.50	1.02	1.80	2.18	1.78	1.53	1,33
F test	NS	Sig.	Sig.	Sig,	Sig,	Sig.	Sig,	Sig.	Sig.
Method of propagation									
Seed	0.06	0.21	0.55	1.08	1.84	2.16	1.80	1,55	1.38
Cutting	0.05	0.24	0,54	1.12	1.90	2.38	1.88	1.60	1.41
F test	NS	NS	NS	NS	NS	Sig,	NS	NS	NS
SEm±	0.02	0.02	0.02	0.04	0.04	0.04	0.03	0.03	0.03
CD (0.05)	—	0.06	0.06	0.12	0.12	0.12	0.09	0.09	0.09

NS = Not significant

Table 2

Mean NAG (g/dm²/week), CGR (g/dm²/week) and RGR (g/g/week) of periwinkle as affected by plant type and method of propagation

Treatment	Mean NAR		Mean CGR		Mean RGR	
	1980-81	1981-82	1980-81	1981-82	1980-81	1981-82
Plant type						
Pink	0.2769	0.2950	0.1902	0.2601	0.1260	0.1458
White	0.2123	0.2650	0.1485	0.1916	0.1159	0.1411
F test	Sig.	NS	Sig.	Sig.	NS	NS
Method of propagation						
Seed	0.2472	0.2782	0.1671	0.2244	0.1220	0.1420
Cutting	0.2420	0.2818	0.1716	0.2273	0.1159	0.1449
F test	NS	NS	NS	NS	NS	NS
SEm±	0.1680	0.0146	0.0176	0,0170	0.0054	0.0032
CD (0.05)	0.1510	—	0.0536	0.0546	—	—

NS = Not significant

Table 3

Growth and productivity of periwinkle as affected by plant type and method of propagation

Treatment	Plant height		Branches/ plant		Stem diameter (cm)		Root yield (kg/ha)		Leaf yield (kg/ha)		Stem yield (kg/ha)		Harvest index		Root-shoot ratio	
	1980-1981	1981-1982	1980-1981	1981-1982	1980-1981	1981-1982	1980-1981	1981-1982	1980-1981	1981-1982	1980-1981	1981-1982	1980-1981	1981-1982	1980-1981	1981-1982
Prant type																
Pink	92.3	96.3	14.1	13.8	1.81	1.89	1247	1401	1460	1699	5384	5540	0.33	0.35	0.179	0.180
White	89.6	97.1	15.2	14.7	1.73	1.83	1004	1209	1301	1551	4382	4639	0.34	0.36	0.177	0.189
F test	NS	NS	NS	NS	NS	NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	NS	NS	NS	NS
Method of propagation																
Seed	91.8	95.3	13.8	14.0	1.76	1.81	1190	1340	1304	1611	4895	4995	0.33	0.36	0.188	0.196
Cutting	90.1	98.1	15.5	14.5	1.78	1.91	1061	1270	1457	1639	4871	5184	0.34	0.35	0.170	0.182
F test	NS	NS	NS	NS	NS	NS	NS	NS	Sig.	NS	NS	NS	NS	NS	Sig.	Sig.
SEm±	1.1	1.2	0.9	0.8	0.10	0.11	53	56	41	37	105	138	0.01	0.01	0.004	0.003
CD (0.05)	NS	NS	NS	NS	NS	NS	160	171	122	113	320	417	NS	NS	0.012	0.009

NS = Not significant

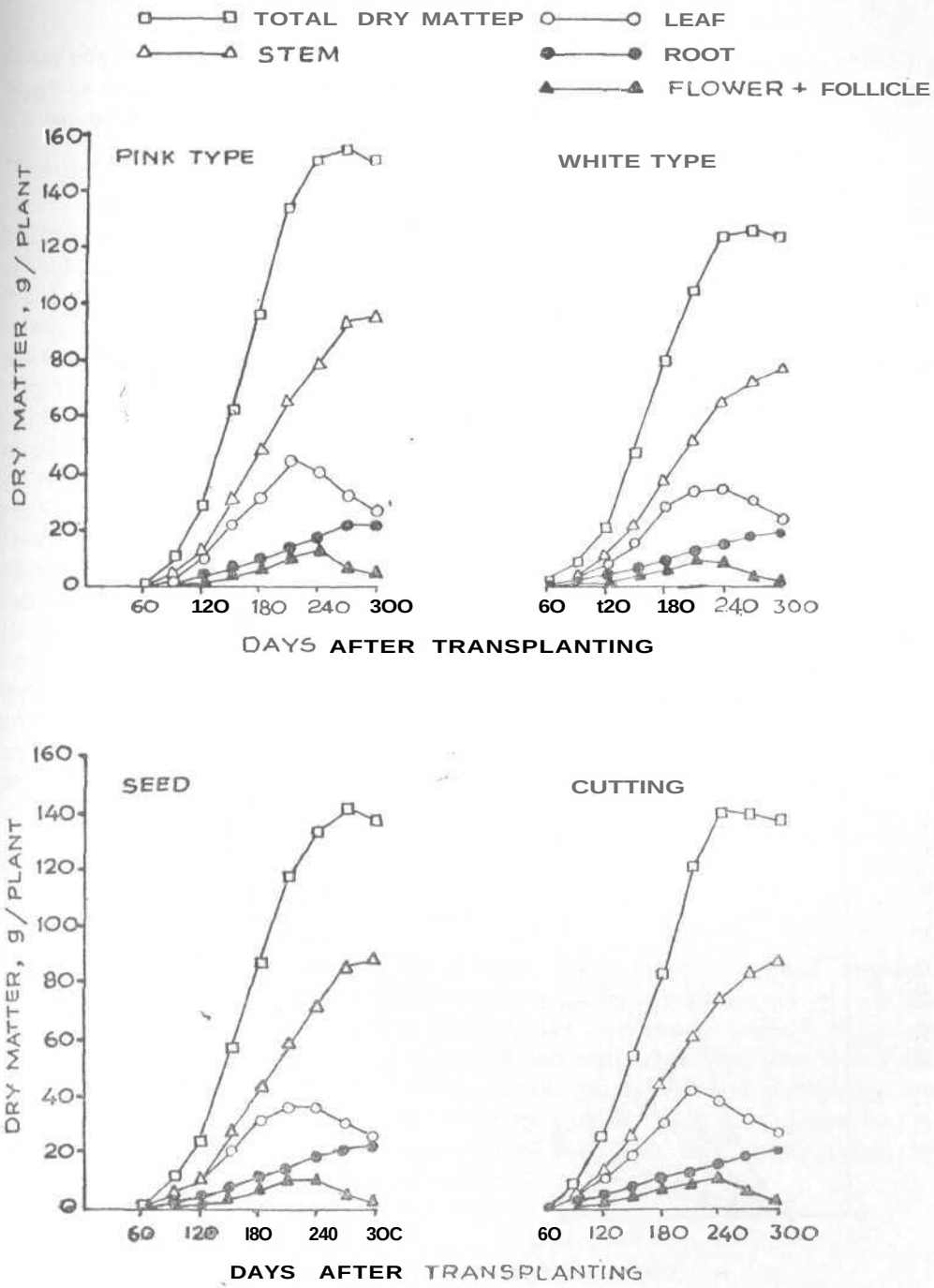

Fig. 1. Dry matter production and distribution in periwinkle as affected by plant typo and method of propagation during 1980-81

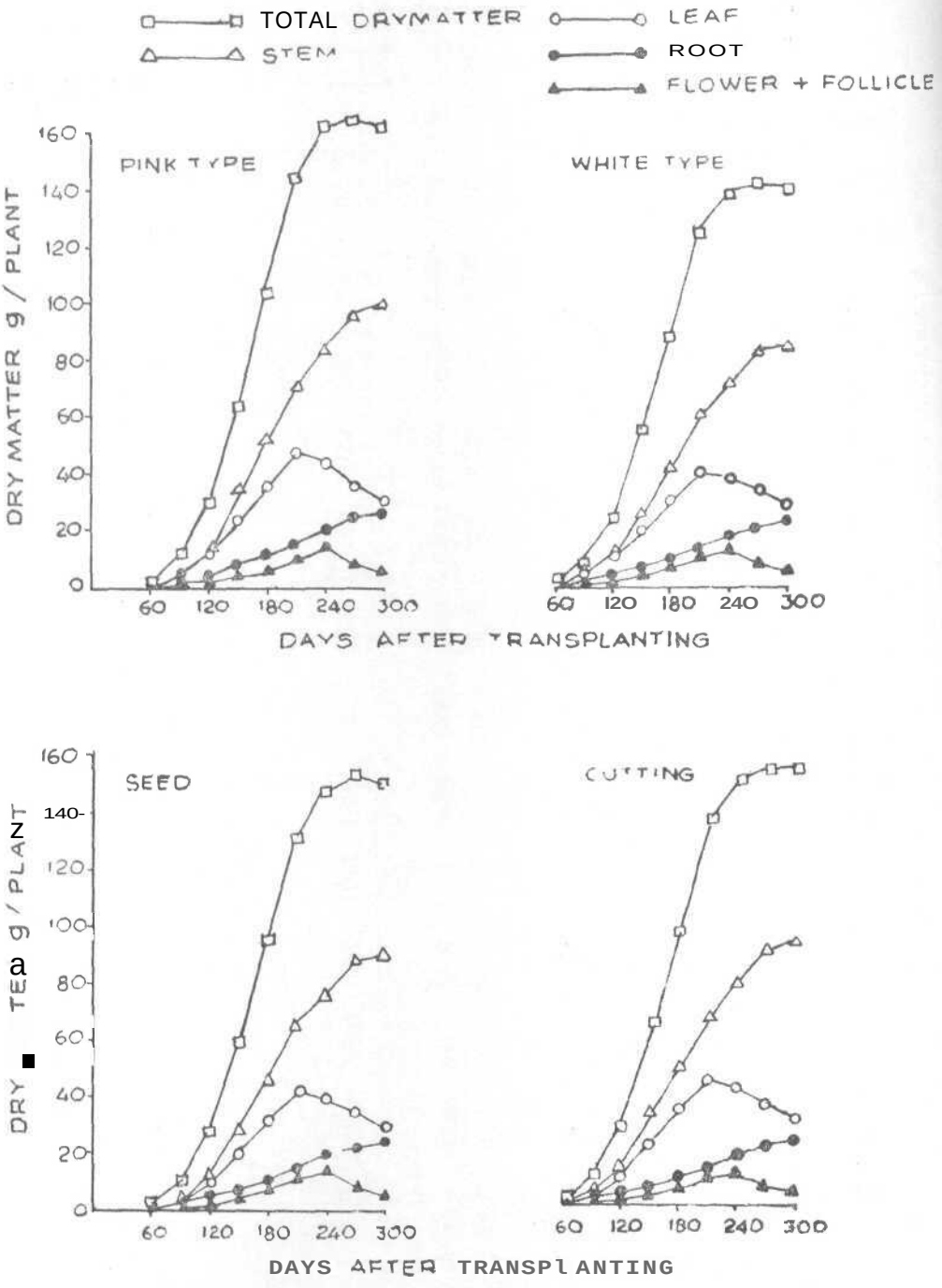

Fig. 2. Dry matter production and distribution in periwinkle as affected by plant type and method of propagation during 1981-82

during both the years. Pink type recorded 16 to 24 per cent more root yield, 10 to 12 per cent more leaf yield and 19 to 23 per cent more stem yield than white type. The harvest index and root-shoot ratio did not exhibit any definite trend.

Effect of method of propagation

There were no significant differences in total dry matter production and its distribution into different parts between the plants raised from seeds and cuttings during both the years (Fig. 1 and 2). LAI also did not differ except at 210 days after transplanting when plants propagated through cuttings had significantly higher LAI than those propagated from seeds (Table 1). The differences in mean NAR, CGR and RGR between plants propagated through seed and cuttings were also not significant (Table 2). Plants propagated through cuttings showed slightly increased plant height, branches per plant and stem diameter although the differences were not significant (Table 3). The productivity in terms of root, leaf and stem yields were also not significantly affected by the method of propagation during both the years except leaf yield during 1980-81 which was significantly higher in plants propagated through cuttings (1457 kg/ha) than those from seeds (1304 kg/ha). As the dry matter production and distribution and growth rates were not affected by the method of propagation, productivity also remained almost the same. These results are in variance with that reported by Bugar and Sarkany (1973). Harvest index was not influenced by the method of propagation. Root-shoot ratio, however, was considerably lower in plants propagated through cuttings (0.170 and 0.182 during 1980-81 and 1981-82, respectively) than in those propagated through seeds(0.188 and 0.196 during 1980-81 and 1981-82, respectively) although the differences were not statistically significant.

The interaction between plant type and method of propagation was not significant.

Summary

Studies were carried out at the Indian Institute of Horticultural Research. Bangalore, during 1980-81 and 1981-82 under irrigated conditions on growth and productivity of pink and white types of periwinkle propagated through seeds and cuttings. It was observed that pink type produced more root, leaf and stem yields than white type as a result of higher dry matter production and distribution and increased photosynthetic surface and efficiency. Method of propagation had no significant effect on growth and productivity of periwinkle and plants propagated through seeds and cuttings were equally good.

Acknowledgement

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