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RESEARCH NOTE: 1

SEED GERMINATION AND ROOT SPROUTING CHARACTERISTICS OF CHROMOLAENA ODORATA (l) R.M.KING AND ROBINSON IN SOUTHWESTERN NIGERIA

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ABSTRACT

Seed germination and root sprouting pattern of Chromolaena odorata, a problem weed of forest nurseries, was studied in southwestern Nigeria. Root sprouting of C. odorata of C. odorata was highest (68%) at 5cm soil depth. The percentage sprouting decreased as soil depth increased. At soil surface only 8.3% of the roots sprouted while at 20cm sprouting was entirely inhibited. C. odorata germinated only at 1cm soil depth and at higher depths there was 100% germination failure. Watering three times a week resulted in 90.5% sprouting of C. odorata roots. There was no root that sprouted when watering was done once in two weeks

and when it was kept permanently flooded. Tilling the soil to 20cm depth particularly at the end of the rainy season will be effective in reducing C. odorata population by simultaneously exposing the roots to desiccation at the surface and burying the seeds into deeper depths where germination is hampered.

INTRODUCTION

Chromolaena odorata (L) King and Robinson, a woody perennial plant, belongs to the family Asteraceae. Although introduced into Nigeria from Sri Lanka, it has become a predominant feature of the rainforest vegetation of Nigeria (Lucas, 1989). In tree plantations and forest nurseries C. odorata had been noted to be among the dominant weed species, competing and smothering economic plant species in the process particularly in forest nurseries (Aya, 1977; Amakiri, 1989). Similar observations were made in cassava and yam – based cropping systems (Gill et al., 1983). Several control measures which included mechanical, chemical and biological methods have been employed to control its spread (Ivens, 1974). The spread of C. odorota is aided by its dual reproductive methods that enable it to occupy and spread in already infested sites through root regeneration while colonizing new locations with seeds, dispersed in large numbers (Radosevich and Holt, 1984). Regenerated seedlings of C. odorata from the roots grow more vigorously and display tolerance to a wider range of environmental conditions because they are equipped with greater food supply than those from the seeds (Gywnne and Murray, 1985). In forest plantations, regenerated *C. odorata* seedlings pose greater threat to crops because of inherent competitive advantage (Tucker, 1993). The common methods of controlling weeds in forest nurseries and plantations in Nigeria are through hand weeding, hoeing and slashing; but these methods are time consuming and laborious. In the country, use of herbicides has been on the increase but farmers are handicapped because they are costly and unaffordable to the most farmers in Nigeria. This study was aimed at understanding the germination and regeneration characteristics of C. odo-

rata seed and root in order to device appropriate technology for its management.

MATERIALS AND METHODS

The study was carried out in 1994 and 1995 at the Teaching and Research Farm, University of Ibadan, Nigeria (7°35'N; 3°47'E); a location with sandy loam soil and a mean annual rainfall of 1845mm. Roots and seeds of C. odorata were collected from existing population at the experimental site. The roots were cut at surface level, washed, air dried for 30 minutes and weighed. Roots that weighed between 9 to 10g were selected for the trial. An initial survey (unpublished) indicated that 9.4g was the average root weight for 1-year old seedlings in the area. In order to investigate the effect of soil depth on root sprouting of C. odorata, circular holes of 30cm diameter and 1m apart were dug to various soil depths. Depths of 1,5,10 and 20cm were established and covered with a meshed screen at the base to facilitate root recovery. A single root was planted into each depth and later covered with topsoil. The experiment was laid out in a randomized complete block design and replicated six times. Soil temperature was monitored daily at 009, 013, and 020 hours through out the trial.

A similar trial was conducted with C. odorata seeds but the treatment depths used were 1,3,5,7,9, and 11cm. Four hundred seeds were planted at each depth. The experiment was also replicated six times.

Effect of availability of soil moisture on root sprouting of C. odorata was investigated using pots filled with 10g of top soil. Moisture regimes were established by varying the frequency of irrigating the pots with 1.5 liters of water. The treatments were as follows: permanently wet; watering three times a week; watering once a week; and watering once a fortnight. In each pot a single root was planted 5cm deep in to the soil. A completely randomized design with six replications was used in conducting the trial. In both experiments, incidence of root sprouting and seed germination were monitored and recorded for ten weeks. The data collected were subjected to Analysis of Variance and the means separated using

Fisher's least significant test.

RESULTS AND DISCUSSION

The mean temperatures at 1, 5, 10 and 20cm soil depths were 26.9, 26.1, 25.9, and 25.7 °C. Maximum root sprouting (68%) was at 5cm depth (Table 1).

Table 1: Mean Root Sprouting (%) of Chromolaena odorata from various soil

Soil Depth	% Root Sprout
1cm	8.3a
5cm	67.7c
10cm	46.1b
15cm	28.3b
20cm	0.0

Means followed by the same letter(s) are not. Significantly different at 5% level of probability.

At 1cm soil depth, sprouting was significantly reduced to 8.3% compared to that of 5cm while at 20cm soil depth root sprouting was totally inhibited. This may attributed to reduced aeration at 20cm depth. At 1cm soil depth the roots were exposed to desiccation caused by high temperatures and this prevented about 87.7% from sprouting. Similar response was reported with Cyperus esculentus L. and Cynodon dactylon L. whose sprouting was reduced by 90% when exposed to the soil surface (Thomas, 1969). Cultural practices that could bring C. odorata to the soil surface will reduce the weed population. The number of roots that sprouted was reduced at soil depth below 5cm. However, that C. odorata could sprout from 15cm soil depth could provide a mechanism to escape control from applied herbicides (Brecke, 1995).

In the case of *C. odorata* seed, germination was observed only at 1cm soil depth. At depths deeper than 1cm there was no germination (Table 2).

The inability of C. odorata seeds to emerge from soil depths below 1cm soil depth could be attributed to the seed size and light requirement. Light penetration into the soil is generally limited to the first few millimeters of the soil

Table 2: Mean Seed Germination (%) of Chromolaena odorata from various soil depths for the two-year trial.

Soil Depth	% Seed Germination
1cm	73.5 ± 2.8
3cm	0.0
5cm	0.0
7cm	0.0
9cm	0.0
11cm	0.00

suggesting that seeds located deeper in the soil may not receive light exposure and this may result to germination failure (Woolley and Stoller, 1978; Blackshaw, 1992). Seedlings from small-sized seeds lack the desired vigour to emerge from higher soil depths, therefore such species show preference to germinate at the soil surface (Woolley and Stoller, 1978). Similar germination response to differences in soil depth had been reported for Eupatorium applilifolium and E. compositifolium whose seeds were only able to germinate from 0.75cm and 1.0cm depth respectively (MacDonald et al., 1992).

Root sprouting was significantly higher in treatments that were watered three times (Table 3)

Table 3: Mean Root Sprouting (%) of Chromolaena odorata as affected by various watering frequencies for two-year trial.

Watering Frequencies	% Root Sprout
Once per 2 weeks	0.0
Once per week	37.6a
Thrice per week	90.5b
Once daily	18.2a
Permanently wet	0.0

Means followed by the same letter(s) are not Significantly different at 5% level of probability.

Watering daily significantly reduced the number of roots by 58% compared with treatments that had three wetting regimes. There was no root sprouts in treatments watered once in two weeks and those under permanent wetting. Excessive soil moisture created reduced aeration which caused decaying of C. odorata roots. This suggests that flooding will be effective in controlling C. odorata. Also water stress inhibits root sprouting as demonstrated by the response of C. odorata to watering once in two weeks. Perhaps this explains the diminishing presence of the weed in the Sudan savanna region of Nigeria.

In forest plantations infested with C. odorata, soil tillage particularly at the end of rainy season is being encouraged in order to simultaneously expose the roots to desiccating at the soil surface and bury the seeds, which naturally rest on the soil surface to deeper depth where germination is not possible. This cultural practice will effectively reduce C. odorata population (Yenish et al., 1992). Since C. odorata could sprout from 15cm depth. it is essential therefore that soil applied herbicides when in use, should be ploughed in to the soil to achieve effective control of the weed

REFERENCES

Amakiri, M.A and E.A Ajiboye. 1989. Evaluation of 3 soil - applied herbicides for weed control in Gmelina arborea. Nigerian Journal of Weed Science 2:45-49

Aya, F.O. 1977. Studies on the Importance and Control Amaranthus spinosus and Eupatorum odoratum in Oil palm nurseries and plantation. Ph.D Thesis University of Ibadan 293 Pp.

Blackshaw, D. 1992. Soil Temperature, Soil Moisture and seed Burial Depth Effect on Red Stem Filaree. Weed Science 40:204-207.

Brecke, J. 1995. Wild Poinsettia (Euphorbia heterophylla). Germination and Emergence. Weed Science. 10: 103-106.

Gills, L.S., Y. Karatella, and M.F Akhatar. 1986. Plant Protection

in the Tropics. 3:131-133.

Gwynne, G. and S. Murray. 1985. Weed Biology and Control in Agriculture and Horticulure. Batsford Academic and Educational. London 258 Pp.

Ivens, C.O. 1974. The Problems of Eupatorium odoratum in Nigeria PANS 20:25-36.

Lucas, E.O. 1989. Siam Weed (Chromolaena odorata) and Crop Production in Nigeria. Outlook of Agriculture 18:8-18.

MacDonald, G.T., E.J. Brecke and D.G. Shilling. 1992. Factors Affecting Germination of Dog Fennel (Eupatorum Capilifolium) and Yankee Weed (Eupatorium compositifolium). Weed Science 40:424-428.

Radosevich, S.R. and J.S. Holt. 1984. Weed Ecology, Implications for Vegetation Management. John Wiley and Sons, Canada 63Pp.

Sheldrick, B.E. 1968. The Control of Siam Weed Eupatorium odoratum) J. NIFOR 5:7-19.

Thomas, P.E.L. 1969. The Effect of Soil Depth and Temperature on Rhizome Development of Cyperus esculentus and Cynodon dactylon. Weed Science 17:200-205.

Tucker, D. 1993. Chromolaena odorata Research Needs. Weed Science Research Highlights. International Institute of Tropical Agriculture, Ibadan, Nigeria. 15Pp.

Turner, D. 1968. Andropogon repens (L) Beauv. Some Effect of Rhizome Fragmentation,Rhizome Burial and Defoliation. Weed Research 8.298-300.

Woolley, J.T. and F.W. Stoller. 1978. Light Penetration and Light Induced Seed Germination in the Soil. Plant Physiology 61:597-602.

Yenish, J.P., J.D. Doll and O.D. Buhler. 1992. Effect of Tillage on Vertical Distribution and Viability of Weed Seeds in the Soil. Weed Science 40:424-433.