

Effect of Integrated Nutrient Management on Growth and Yield of Barley (*Hordeum Vulgare*) by using *Arundo Donax* in Integrated Management of Barley Crop

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ABSTRACT

Arundo donax was screened for their allelopathic potential to the growth of barley seedlings. The 3% aqueous leachate was tested for seed germination of barley in laboratory bioassay. The *Arundo donax* was found to enhance the growth of barley seedlings. The aqueous leachate of Bg parts was more pronounced growth of barley seedlings than Ag parts. This study suggested the future prospects of the integrated management of barley crop using the allelopathic potential of *A. donax*.

KEYWORDS: Allelopathic potential, leachate, integrated management, barley, crop, nutrient

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INTRODUCTION

Arundo donax L., the Giant reed (Poaceae), native to Europe is perennial, cane like grass found in tropical to temperate regions. The plant is of high economic importance. It is used in making roof and construction material (Anderson, 1991). Giant reed stem is used in preparation of walking sticks, finishing poles, mats and basket. It was well known to exhibit allelopathy in aquatic ecosystem. *A. donax* form large continuous clonal root masses and accumulate allelochemicals in their rhizospheric soil and form monospecific stands (Szczepanska and Szczepanski, 1982; Sharma, Khushwaha and Gopal, 1990; Gupta, 1998; Khatri *et al.*, 2007). Allelochemicals like plant hormones (Olofsdotter, 2011) show both growth promoting and inhibiting properties depending upon its concentration (Narwal, 1999). Gupta (1998) confirmed that field soil of *A. donax* accumulated allelochemicals of phenolic nature which inhibited the growth of many crops. In this present study *A. donax* promoted the growth of barley seedlings.

Materials and Methods:

Arundo donax L., plants with rhizome were collected from Botanical garden, Dr. Bhim Rao Ambedkar Govt. College Sri Ganganagar for study their allelopathic potential against test crop barley (*Hordeum vulgare* variety Raj.4229). The below ground portions of samples were cleaned with soft brush. These samples were washed gently with tap water and distilled water thereafter and dried on absorbent paper. The leachate of three percent concentration (w/v) of *A. donax* was prepared by soaking 3g plant material in 100 ml of distilled water, each for 24h and then filtered. Pre-soaked material was separated after filtering through fine muslin cloth and the aliquot obtained was used as aqueous leachate.

In vitro Seed Germination and Seedling Growth Lab Bioassay

The *in vitro* seed germination and seedling growth bioassay experiments were performed on the growth of test crops barley under laboratory conditions. The seeds of crops were surface sterilized with 0.1 %

HgCl₂ solution for one minute and washed thereafter 4-7 times with sterilized distilled water and dried with filter paper. The pre-sterilized petriplates (9 cm) were lined with two filter papers. Ten healthy seeds of test crops were placed at equidistance on top of the filter paper in petriplates. Each treatment was replicated 3-5 times for test crop barley. As per treatment, each petriplate received 5 ml of leachate on first day and 3 ml leachate on 2, 4 and 6 days after sowing (DAS). The petriplates were kept in BOD incubator at and 25-30°C. The seedlings were harvested 7 days after

sowing and germination of seeds, lengths of shoot and root of seedlings were measured. Subsequently, these were kept in an oven for drying at 80°C for 24 h and weighed thereafter for total dry weight.

Results and Discussion:

The data on the impact of aqueous leachate of 3% (w/v) concentration of above ground (Ag) and below ground (Bg) plant parts of *Arundo donax* on germination and growth of barley seedlings is given in Table 1.

Table 1: Allelopathic impact of 3 % (w/v) aqueous leachate of above ground (Ag) and below ground (Bg) plant parts of *Arundo donax* on test crop barley

Growth parameters	Control	<i>A. donax</i>		LSD
		Ag	Bg	
Germination (%)	90.00 ± 5.77	88.00 ± 0.00	83.33 ± 3.33	11.00
GIR	-	11.11	6.4	-
Root length (cm)	1.81 ± 0.12	1.68 ± 0.01	2.42 ± 0.00*	0.40
Shoot length (cm)	1.56 ± 0.17	1.82 ± 0.01	1.91 ± 0.01	0.28
Total dry weight (g)	0.026 ± 0.01	0.031 ± 0.01	0.037 ± 0.01*	0.00

Mean ± SE, GIR- Germination inhibition rate, LSD - Least significant differences, * Significant at 0.05 % level by Dunnett's test applied after ANOVA

The aqueous leachate of Bg parts of *A. donax* increased the growth of barley seedlings. Whereas Ag parts did not show any marked difference over the control. The % germination was 89 and 93% of control in Ag and Bg parts respectively. The root length remained 86% of control in Ag part whereas it increased to 127% of control in Bg part. In case of shoot, the length was 113 and 119% of control in Ag and Bg parts respectively. Total dry weight was 100 and 134 % of control in Ag and Bg parts respectively at 7 DAS (Fig 1.).

The ANOVA was significant in root length and total dry weight. The shoot length and % germination was found to be insignificant. Further, Dunnett's test was applied to determine the significant differences between each mean of treatment. It showed that Bg part effectively enhanced the root length and total dry weight of barley seedlings.

A. donax forms the monoculture stands that physically inhibited the other species (Rieger *et al.*, 1989; Bell, 1997).

Arundo donax

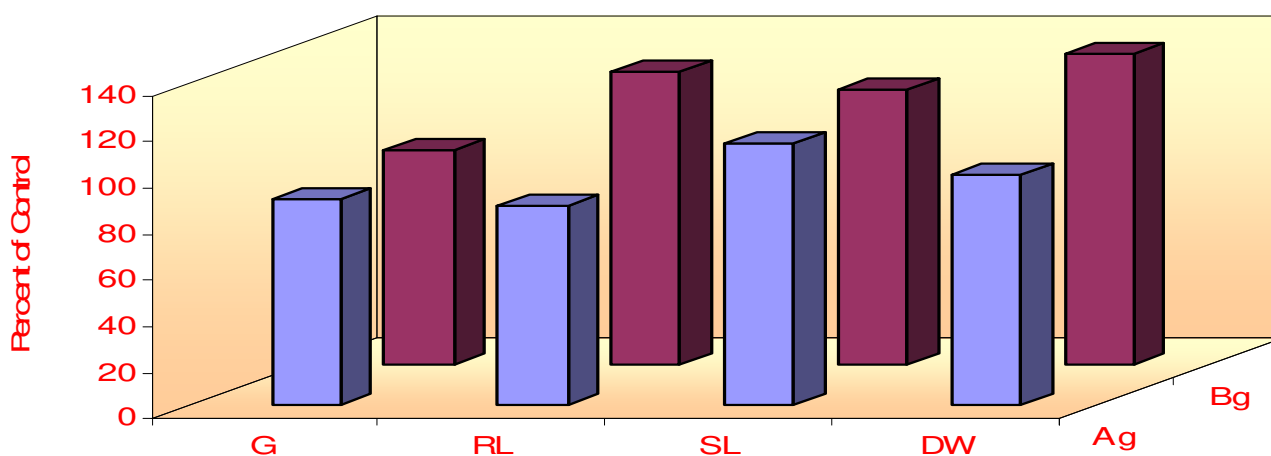


Fig. 1- G -% Germination, RL - Root length (cm), SL - Shoot length (cm), DW - Dry weight (g), Ag - Above ground plant parts, Bg - Below ground parts

Gupta (1998) confirmed that field soil of *A. donax* accumulated allelochemicals of phenolic nature which inhibited the growth of many crops.

Conclusion:

Similarly the present study shows that above ground parts of *A. donax* was found more toxic to the growth of barley than belowground parts. *A. donax* promoted the growth of barley plants obviously due to the presence of low concentration of bioactive compound in Bg parts than Ag parts. This study suggested the future prospects of the integrated management of barley crop using the allelopathic potential of *A. donax*.

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Arundo donax

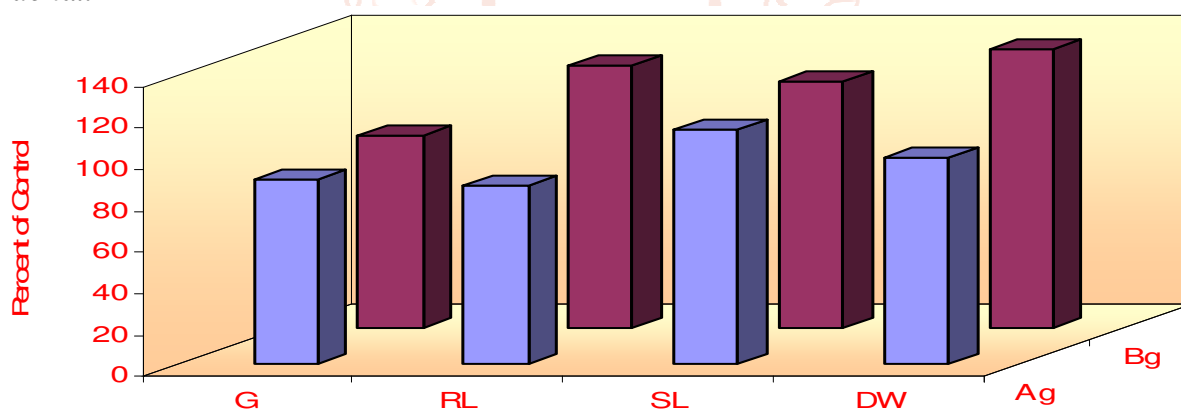


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