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Sunflower dried stalk extract: A natural Preemergence herbicide: Effect on crops and weeds seed germination

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Abstract

The aim of this investigation was to study the effect of sunflower dried stalk solution on germination of crop and weed seeds under various concentrations. Four rates of sunflower dried stalk solution on weight by volume basis such as 0.25, 0.50, 0.75, 1 kg in 10 liters of water were taken and sprayed into the pots with 20 cm diameter and a control was also maintained. Seeds of five crops and six weeds were sown. Germination percentage and dry weight of crops and weeds were recorded for each pot. Sunflower dried stalk solution with 1:10 w/v basis reduced mean germination by 9.4% for *Abutilon indicum*, 8.4% for *Parthenium hysteroporus*, 7.2% for *Amaranthus viridis*, 9.0% for *Trianthema portulacastrum*, 11.9% for *Cynodon dactylon*, 10.1% for *Cyperus rotundus*, 7.9% for Maize, 9.1% for Blackgram, 7.6% for Greengram, 6.9% for Cowpea, and 8.9% for Pearl millet, compared with the control. The dry weight of crops and weed seeds was also reduced with Sunflower dried stalk solution with 1:10 w/v dose and so direct seeding of these vegetables into soil into which Sunflower dried stalk solution has been incorporated is not advisable. Using transplants may be an alternative that takes advantage of the herbicidal effects of Sunflower dried stalk solution and thus prevents the weed emergence.

Keywords: Pot culture experiment, Sunflower dried stalk solution, crop and weed seeds, germination percentage and dry weight

Introduction

Weeds are considered the most important pest group for farmers interested in lowering external inputs and avoiding synthetic chemical use. Sunflower dried stalk solution is a natural preemergence weed controller and has a potential to inhibit germination of weed seeds and was found to be effective in many crops in reducing germination of many broadleaf and grass weeds. Concern over the long-term ecological effects of synthetic agricultural chemicals has led to increased efforts in the search for natural products (Cardellina, 1988) [3]. Allelopathic chemicals found in natural products may be used directly as herbicides and to develop new classes of synthetic herbicides based on natural chemicals (Narwal, 1996) [9]. The cultivated sunflower (*Helianthus annuus* L.) is economically important oilseed crop. Studies indicated that sunflower can actively influence the growth of surrounding plants and is known to exert strong allelopathic influence against other plant species (Cheema *et al.*, 1997 and Macias *et al.*, 1999) [4, 6].

Cheema *et al.*, 1997 [4] found that aqueous extract of sunflower has the potential to suppress the weed infestation in wheat crop. Concentrated sorghum water extract 100% reduced the germination of *T. portulacastrum* 15 to 20% and root shoot length of this weed was also significantly reduced at 75 and 100% concentrations, (Randhawa *et al.*, 2002) [10]. Sunflower leaf extracts successfully kills broad leaved weeds such as *C. album* and *Rumex dentatus* resulting in significant increase in wheat yield, which shows considerable potential for sunflower to use as natural herbicide (Anjum and Bajwa, 2007) [2]. Aliakbar Askeri and Pepoyan (2010) [1] founded that sunflower and walnut, have allelopathic potential on different weed species and also discovered that sunflower and walnut in rotation system may aid in non-chemical weed management strategies.

A pot culture experiment was conducted at Tamil Nadu Agricultural University, Coimbatore to evaluate the herbicidal property of Sunflower dried stalk solution. The pot culture experiment was carried out in completely randomized block design with four replications. Different doses such as 0.25:10, 0.50:10, and 0.75:10 and 1:10 w/v basis along with control were taken in pots. Five types of crop seeds and six types of weed seeds were sown. Germination percentage and dry weight was recorded. The result revealed that the 1:10 w/v basis of sunflower dried stalk solution dose reduced the germination of both crop and weed seeds. The dry weight of crop and weed seeds were also found to be less in 1:10 w/v basis of sunflower dried

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stalk solution dose. Hence sunflower dried stalk solution dose is recommended for crops since it has herbicidal activity.

Materials and Methods

The pot culture experiment was conducted at Tamil Nadu Agricultural University, Coimbatore district, Tamil Nadu. The design followed was Completely Randomized Block Design and replicated four times. The different doses of sunflower dried stalk solutions viz., 0.25, 0.50, 0.75 and 1 kg per 10 litres were taken accordingly. Pots of size 20 cm diameter (circumference of the circle $2\pi r$, was used to calculate the dose of the solution to be sprayed for the pot area) were taken and filled with native field soil. Weed seeds such as *Abutilon indicum*, *Parthenium hysteroporus*, *Amaranthus viridis*, *Trianthema portulacastrum*, *Cyperus rotundus*, *Cynodon dactylon* and crop seeds such as maize, blackgram, greengram, cowpea and pearl millet were sown. Sunflower dried stalk solution was sprayed as pre emergence solution with different doses such as 0.25:10, 0.50:10, 0.75:10 and 1:10 w/v basis and control was also maintained. Germination percentage was taken and also dry weight of weed and crop seeds were taken on 12 Days after Sowing (DAS).

Results and Discussion

The result of pot culture study revealed that, application of sunflower dried stalk solution at 3 DAS significantly influenced the germination of crop and weed seeds as well as dry weight. Among different doses of sunflower dried stalk solution treated pots (0.25:10, 0.50:10, 0.75:10 and 1:10 w/v basis), the 1:10 w/v basis treated pots registered less germination and low growth of weeds and crops and this intern returned on the dry weight of both on 12 DAS.

Germination percentage

The germination percentage of different weed and crop seeds were furnished in Table 1. The pot culture study revealed that the germination percentage of individual weed species was significantly lower in pots were 1:10 w/v sunflower dried stalk solution was applied. The germination percentage of

Abutilon indicum (9.4%), *Parthenium hysteroporus* (8.4%), *Amaranthus viridis* (7.2%), *Trianthema portulacastrum* (9.0%), *Cyperus rotundus* (11.9%), *Cynodon dactylon* (10.1%) were recorded in 1:10 w/v sunflower dried stalk solution dose. The crop seeds maize (7.9%), blackgram (9.1%), greengram (7.6%), cowpea (6.9%) and pearl millet (8.9%) also showed less germination percentage were 1:10 w/v sunflower dried stalk solution was applied. Moderate germination percentages were observed in 0.75:10 w/v basis and 0.50:10 w/v basis of sunflower dried stalk solution doses. The crop and weed seeds in control showed higher germination percentage than various doses of sunflower dried stalk solution.

Dry weight

Dry weight of different weed and crop species recorded were presented in the Table 2. The result showed that the dry weight of weed and crops were less in 1:10 w/v sunflower dried stalk solution dose. The dry weight of *Abutilon indicum* (117 mg), *Parthenium hysteroporus* (122 mg), *Amaranthus viridis* (109 mg), *Trianthema portulacastrum* (95 mg), *Cyperus rotundus* (116 mg), *Cynodon dactylon* (105 mg) were recorded in weeds were 1:10 w/v sunflower dried stalk solution is applied and in crop seeds such as maize (114 mg), blackgram (124 mg), greengram (106 mg), cowpea (123 mg) and pearl millet (121 mg). Moderate dry weight of crop and weeds were recorded in 0.75:10 w/v basis and 0.50:10 w/v basis of sunflower dried stalk solution doses. Control showed significantly higher weed dry weight of crop and weeds than other doses of sunflower dried stalk solution.

Spraying of sunflower dried stalk solution @ 1:10 w/v basis showed less germination percentage and dry weight in crop and weed seeds (Fig.1 & 2). This response could be attributed to a greater contribution of allelochemicals from different parts of sunflower. This was in agreement with the findings of Muhammad Naseem *et al.* (2013) [8] who reported that inhibitory effects on germination of seeds increased with increasing the sunflower plant extract application doses and also frequency. The results are in accordance with the findings of Mubeen *et al.* (2013) [7] and findings of Khaliq *et al.* (2009) [5].

Table 1: Effect of sunflower dried stalk solution on germination of weed and crop seeds in pot culture experiment

Treatment w/v basis	Germination Percentage of Weeds (%)						Germination Percentage of Crop seeds (%)				
	<i>Abutilon indicum</i>	<i>Parthenium hysteroporus</i>	<i>Amaranthus viridis</i>	<i>Trianthema portulacastrum</i>	<i>Cyperus rotundus</i>	<i>Cyanodon dactylon</i>	Maize	Blackgram	Greengram	Cowpea	Pearl millet
0.25:10	83.3	85.1	90.9	87.9	92.5	84.3	91.8	91.2	91.0	91.6	93.7
0.50:10	73.0	77.2	82.0	74.2	80.0	75.5	75.6	77.0	71.2	69.8	72.8
0.75:10	26.5	23.3	27.1	28.7	40.6	39.6	29.2	37.2	36.2	35.5	33.8
1:10	9.4	8.4	7.2	9.0	11.9	10.1	7.9	9.1	7.6	6.9	8.9
Control	89.5	89.9	94.6	95.1	91.1	88.5	93.2	92.1	94.1	93.7	96.5
S.Ed	2.7	2.6	2.8	2.7	3.4	2.8	2.9	2.8	2.9	2.5	2.9
CD (P=0.05)	5.9	5.9	6.0	5.9	7.3	5.9	6.3	6.4	6.3	5.9	6.6

Table 2: Effect of sunflower dried stalk solution on dry weight of weeds and crops in pot culture experiment on 12 DAS

Treatment w/v basis	Dry weight of Weeds (mg)						Dry weight of Crops (mg)				
	<i>Abutilon indicum</i>	<i>Parthenium hysteroporus</i>	<i>Amaranthus viridis</i>	<i>Trianthema portulacastrum</i>	<i>Cyperus rotundus</i>	<i>Cyanodon dactylon</i>	Maize	Blackgram	Greengram	Cowpea	Pearl millet
0.25:10	1054	892	973	985	765	813	649	520	431	562	392
0.50:10	880	792	785	888	659	705	586	467	388	365	340
0.75:10	609	652	602	649	475	420	425	292	212	323	185
1:10	117	122	109	95	116	105	114	124	106	123	121
Control	1136	1080	1165	1082	855	890	693	566	493	601	493
SEd	37	33	33	36	27	28	23	19	15	18	15
CD (P=0.05)	76	70	70	74	57	59	48	40	33	40	32

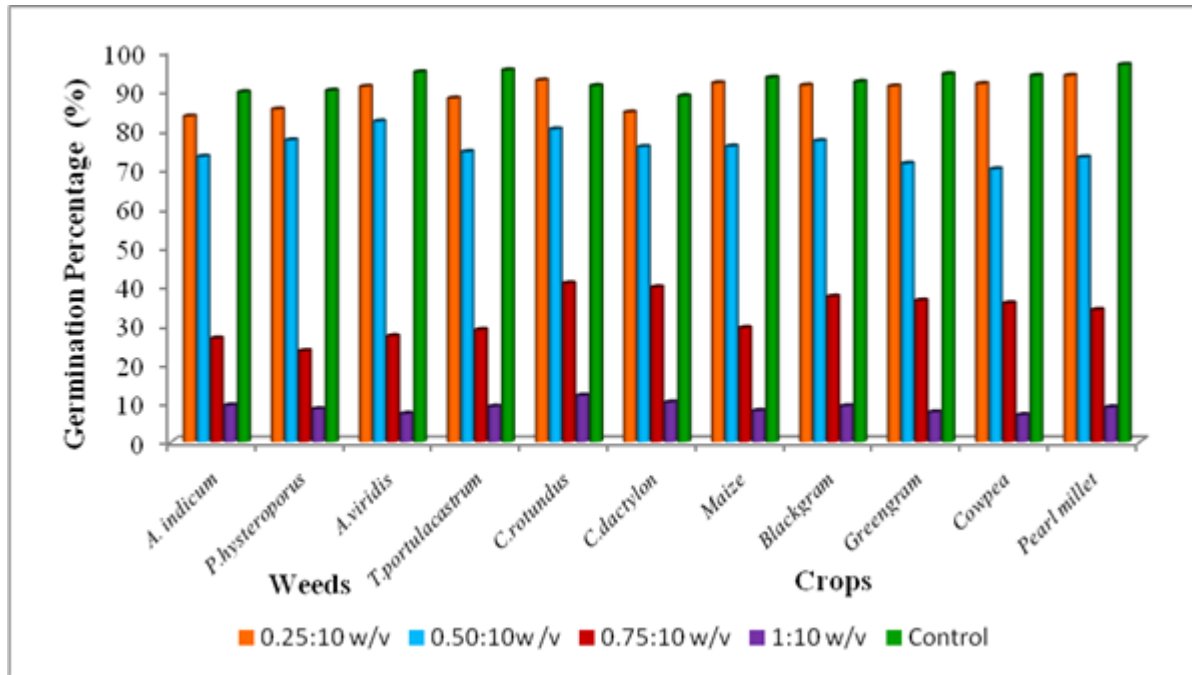


Fig 1: Effect of sunflower dried stalk solution on germination of weed and crop seeds in pot culture experiment

Conclusion

From the above pot culture experiment, it could be concluded that, pre emergence application of sunflower dried stalk solution @ 1:10 w/v basis recorded lower germination percentage and dry weight of both crop and weed seeds and thus it can be very well used as pre emergence herbicide in transplanted crops.

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