Effect of soil solarization and chicken manure on germination and viability of field dodder Cuscuta campestris Iseeds

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Abstract: Field studies were conducted in Basrah reigon to investigate the effect of different durations (0-6wk) of solarization alone on scarified dodder seeds.and solarization with/with out chicken manure on scarified various 20cm). soil seeds at depths(0-20cm).

For both scarified and non scarified dodder seeds,the effect of solarization periods on percent total seeds germination (PTSG) was consistent only at 0 depth. At this depth most of the solarization effect on scarified dodder seeds occurred during the first 10d.

Where the reduction in PTSG was 95% Non scarified dodder seeds required 6wk of Solarization alon for significant reduction (69%) in PTSG at Odepth. Chicken manure redused the period of solarization from 6 to 2 wk for significant PTSG reduction

1-Introduction

Field dodder (Cuscuta campestris) is an annual holoparasitic higher plant in the family Convolvulaceae [3]. Dodder parasitizes stems and leaves of various herbaceous dicots and some monocots like onion (Allium cepa) and asparagus(Asparagus officinalis)but not grasses [3,14]. Potatoes, tomatoes and sugar beet are the major crops parasitized by dodder [9].

Like annual weeds,dodder perpetuation depends on annual production and dormancy of seeds that replenish annual losses from the soil seed bank. A single mature dodder plant produce thousands of hard seeds that may remain viable in soil for 10-20yr [1,8]. Germination is stimulated by scarification of the hard seeds followed by imbibition.Environmental conditions, such as wetting and drying,micro-organisms, mechanical and chemical means may break the hard seed coats of dodder. Under favourable field conditions, between 7and 55% of dodder seeds present on the soil surface or in the upper 0.5cm of soil produce seedling every year[3.8].

Most traditional methods aimed at controlling dodder infestations in the field are expensive and complex,and sometimes fail.

The effectiveness of soil solarization on weed seeds varies with seed type and size soil depth, plastic type, soil moisture, and duration of solarization [6,7,13]. One way which it reduce solarization period by using soil amendments that augment the weed killing effect. Chicken manure is widely used as organic fertilizer and was effective in reducing branched broomrap (Orobanche ramosa)growth and infestation in potatoes[2].

The objectives of this research were to investigate the effectiveness of different periods of solarization alone on

scarified dodder seeds and solarization with/with out chicken manure on non scarified dodder seeds at different soil depths.

2-Materials and methods

Two experiments were conducted in centre of Agriculture research, University of Basrah during the summer seasons of 2000 and 2001, The main objective of this study was to investigate the effect of soil solarization on germination of field dodder seeds.

The soil type is silty clay loam with a pH 7.8 and E.C. 0.80 ds m-1 prior to solarization, the plots were ploughed with amouldboard, disked and levelled Seeds of Field dodder (Cuscuta campestris Yuncker) were used in all experiments.Seeds were Stored dry and in darkness at room temperature until used for experimental purpose.

2.1-Solarization-2000

This study was conducted to investigate the effect of different solarization periods on scarified dodder seeds located at various soil depths.Scarification was done by soaking and stirring dodder seeds for 20 min.in concentrated sulphoric acid. Seeds were then caught on a wire screen rinsed several times with tap and distilled water and air-dried [10]. Lots of 100 scarified dodder seeds were mixed with 5g of the field soil and placed into a 4cm*6cm polypropylene mesh bags [5]. The bags were buried horizontally at 0.5.10.15 and 20 cm soil depths (Ibag/depth). The bags were 0.5-1em thick,and seeds at 0 depth were actually 0-1em

deep. The mesh size of the bags were small enough (270*770 μm) to retain dodder seeds and permit free

movement of water, gases and micro-organisms through the bag. The field was then irrigated to field capacity (60%), and covered with one layer of transparent polyethylene sheet (0.3mm thik). Solarization was carried out between July2land August 30 in2000 for0,10,20,30and40d.Soil thermometres were inserted in the centre of the plots at various depths Maximum temperatures were recorded every day at 1300-1400h. The treatments were replicate 5 times(I bag or 100 seeds/replicate) and arranged in a randomized complete block design with 2m*3m plots.

2.2- **Solarization 2001.**

This study conducted to investigate the effect of different periods of solarization alone or in combination with chicken manure on non scarified dodder seeds at various soil depths Prior to solarization, one-week old layer chicken manure al 20t/ha was mixed with soil. One hundred non-scarified dodder seeds were placed in each polypropylene bags (previously described) and buried at 0,5 and 10cm deep Seeds were solarized through transparent polyethylene sheets (0.05mm thickness) Between July23 and Septemper 4 in 2001 for 0,2,4 and 6wk.

2.3-Recovery and testing of dodder seeds.

Bags of dodder seeds from each depth were recovered after various durations of solarization At the end of each duration,five plots were uncovered and bag/plot/depth(5bags or 500 seeds/depth) was carefully one Recovered for germination tests. The bags were washed opened and recovered seeds were washed with tap and distilled water and air-dried. the first study (2000)the seeds. from each bag (100 seeds) were sown in13cm*5cm*3cm plastic boxes with lids Each box contained one piece of

blotter germination paper wetted with 5ml of distilled water and incubatedin darkness at 28co. The second study (2001) was similar except that the recovered non-scarified dodder seeds were (as previously described) before planting. The total number of seeds tested in both experiments was 33,000.

2.4- **Experimental measurements and statistical analysis.**

The number of germinated seeds in each box was recorded every other day over a

12-d test period All germinated seed were counted and removed Seeds were considered germinated once the radicle had appeared. The total number of germinating seeds consisted of the sum of six germination tests for each replicate or

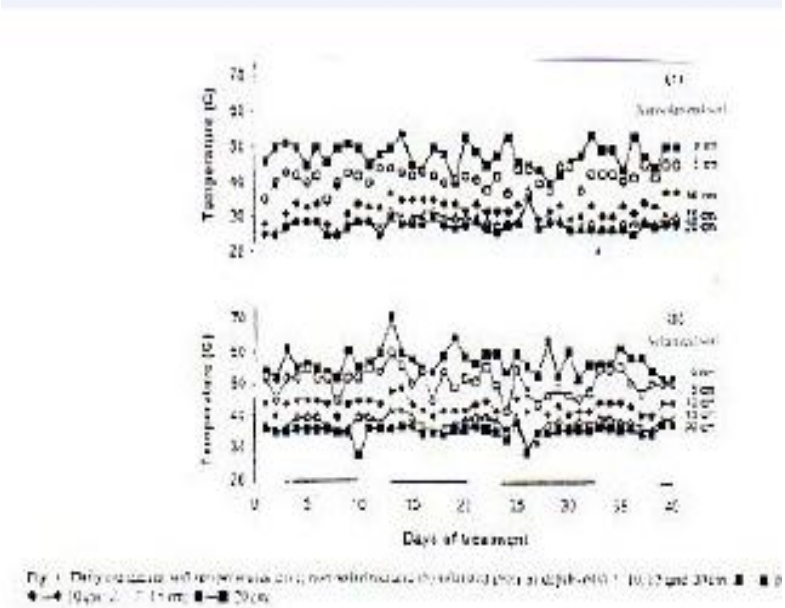
box Firm seeds that did not germinate during the 12-d test period were cut and treated with 1% tetrazolium(TZ)for viability,and viewed under a dissecting microscope.Empty seed coats collapsed when squeezed and were recorded as non-viable.

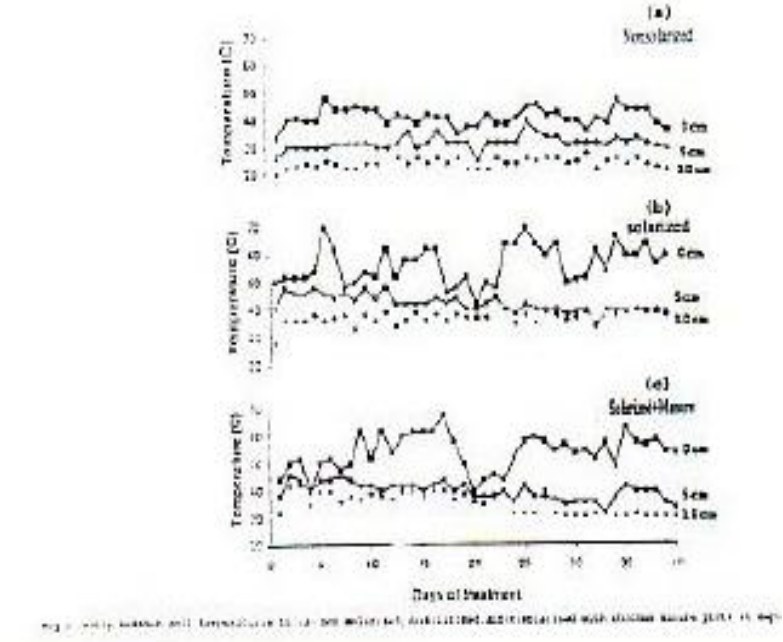
Percentage seed germination (PSG) data and percent total seeds germination (PTSG)data were arcsine transformed before analysis and mean separation was performed on analyzed data .Presented data are the original average of five replicates Means of five replication (500seeds) were analyzed for variance and significant differences were determined by Doncan's multiple rang test at the 5%probability level.

3-Results and discussion:

3-1- Effects of soil solarization on soil temperature.

Mulching the soil with transparent polyethylene sheets increased the maximum soil temperatures in the upper and 5cm depth, compared to non solarized treatments (fig land2). Temperatures decreased with soil depth.Peak soil temperatures recorded in solarized treatment in season of 2000 were 71,59,49,42and38c° at depth of 0,5,10,15 and 20cm.


Temperature (C)
Days of treatment


(a)
Non-solarized
(b)
solarized
(c)
Solarized+Manure
Temperature (C)
Days of treatment

respectively (fig. 1), and in season of 2001 were 70.48and44c° at depths of 0,5 and 10cm,respectively (fig.2).Chicken manure did not increase the soil temperature compared to solarization alone (fig.2).

3.2- **Solarization effects on scarified dodder seeds-2000.**

All solarization treatments significantly reduced the PTSG of dodder seeds at 0 deph In comparison to their respective non-solarized controls(table 1). Most of the significant effect of solarization occurred in the first 10d, where the reduction in PTSG was 95.6% at 0cm and 84% at 5cm.At 10,15and 20cm, PTSG in all solarization treatments was not significantly different from the respective controls. The significant reduction in PTSG at 0and 5cm depths could be due to high soil temperature during solarization. Seeds deeper than 10cm could have germinated and then died during solarization, since temperatures were within the rang optimum for germination [1].

3.3- **Solarization effects on non-scarified dodder seeds 2001:**

Analysis of variance indicated that treatments had a significant effect on PSG, andPTSG but not on TZ test results(table 2). Vaibility results were not significantly affected by any solarization treatments.Tetrazolium test results did not exceed five viable seeds in any of the treatments, and ranged from 0 to 5 viable seeds,regardless of presence or absence of solarization.period of solirazation soil depth,or presence or absence of chicken manure(table 2) Since the TZ test was performed on non germinated seeds to check for viability, results of this test indicated that most seeds that did

not germinate following initial germination test were dead rather than dormant. For solarization with out chicken manure.the most significant reduction in PTSG occurred at 0 depth after 6 wk of solarization The percent reduction was 69% compared with the control(table 2). The greatest effect of solar heating on weed seeds has been observed on the top soil layer [15].Soil temperature at this depth were between 41and 70 c^o (fig 2).

Fluctuations in soil temperature were found to be a major factor involved in breaking.

hard seed coats of many weeds [17]. This is due to changes in water adsorption by the cell walls in the seed coat causing them to shrink and swell, rupturing the coat [4,12] found the exposure of hard seeds of bindweed (Convolvulus spp.) to high temperature in creased seed-coat permeability and germination. Thus, the reduction in PTSG at Odepth is most likely due to high soil temperatures and fluctuations,which could have scarified dodder seeds causing embryo damage.or death of germinating radicles during solarization [11].

The heating effect of solarization on dodder seeds however.

declined with soil depth, and dodder seeds were insensitive to solar heating at 5(34-48c°)and 10cm (28-44c°) depths. These temperatures were probably not sufficient to break the hard seeds coats of dodder seeds of various weeds emerging from below 10cm were also not effected by solarization [15]. Thus, seed depth and hard seed coat may be the major protection mechanisms for dodder seeds against solar heating Only non dormant dodder seeds present on the soil surface or in the upper 0.5 cm of soil germinate every year [3]. While solarization alone required

6wk to cause a significant reduction in PTSG at 0 depth (69%) solarization with chicken manure was significant for all treatments at 0 depth (table 2). Thus addition of chicken manure reduced the periods of solarization from 6 to2wk for significant reduction in PTSG.At this depth the reduction in PTSG significantly increased with the solarization period, but the effect of chicken manure diminished after 6 wk of solarization. The reduction in PTSG was equal to that for solarization alone.

Chicken manure did not increase the soil temperature to solarized treatment alone (fig2) Many studies indicated that soil pH, micro-organisms, gases and various organic and inorganic compounds are changed in soil after adding animal manure and effect the germination and viability of many weed seeds[12,16].

The dormancy of dodder seeds can be broken by micro organisms [3], it is possible that the dodder seeds in our experments were biologically (microbial activity) scarified leading to their germination in the soil and subsequent death of radicles during solarization.

Our results indicate that scarified dodder seeds can be killed after 10d of solarization Non-scarified seeds require 6 wk of solarization alone for significant reduction in PTSG.Addition of chicken manure has the potential of reducing the required solarization period to 2-4 wk.

Table 1

Effect of different durations of solarization on percent total seed germination (PTSG) of scarified dodder seeds at 0,5,10,15 and 20 cm soil depths

Treatment	Duration(d)	Soil depth(cm)				
		0	5	10	15	20
Control	0	81.6a*	81.6a	81.6a	81.6a	81.6a
Non-solarized	10	78.4a	23.6b	19.6b	15.4b	12.8bc
Solarized	10	3.6b	3.4d	10.6bc	12.2bc	9.4cd
Non-solarized	20	65.4a	12.6c	22.2b	15.6b	21.0bc
Solarized	20	3.6b	9.6cd	18.8b	17.0b	7.0cd
Non-solarized	30	51.2a	17.8c	13.8bc	8.2bcd	7.2cd
Solarized	30	0.2b	1.8de	2.8c	6.8bcd	2.6cd
Non- solarized	40	54.6a	3.0de	4.2c	4.4cd	2.4cd
Solarized	40	0.2b	0.6e	5.0c	1.6d	0.8d

*Means followed by same letter, in each column are not significantly different ,according to DMRT (p=0.05).

Table 2

Effect of different duration of soil solarization and chicken manure on percent seed germination (PSG), viability (TZ), and percent total seed germination (PTSG) of non-scarified dodder seeds at 0,5 and 10cm soil depth in 2001

Treatments	Duration(wk)	Soil depth(cm) 0			5			10		
		PSG	TZ	PTSG	PSG	TZ	PTSG	PSG	TZ	PTSG
Control	0	74a*	5	78a	74a	5	78a	74a	5	78a
Solarized	2	73a	2	75ab	78a	3	80a	81a	1	82a
Solarized	4	70ab	1	71ab	68ab	1	70ab	78ab	2	80a
Solarized	6	22e	2	24e	18e	2	20e	56bc	2	58bc
Solarized + manure	2	64ab	0	64b	50c	2	54b	41c	3	44c
Solarized + manure	4	58b	3	61b	72ab	2	75a	71a	2	73ab
Solarized Manure	6	22e	3	25e	61bc	2	63b	70ab	2	72ab
			0.5			0.5			0.5	

*Means followed by same letter, in each column are not significantly different, according to DMRT (p =0.05).

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تأثير البسترة الشمسية وفضلات الدواجن على نسبة أتبات وحيوية بذور نبات الحامول

ستار جبار فهد

المعهد التقني / ميسان

الخلاصة : أجريت هذه الدراسة لمعرفة تأثير البسترة الشمسية للتربة لمدد وأعماق مختلفة مع استخدام فضلات الدواجن على نسبة الإنبات الكلية لبذور نبات حامول الحقل المتطفلCuscuta compestris .

وقد بينت النتائج بأن البذور التي تم تحفيزها للإثبات سجلت أعلى انخفاض في نسبة الإنبات الكلية ٩٥% خلال العشرة أيام الأولى من عملية البسترة الشمسية ، أما البذور التي لم يتم تحفيزها للإنبات فأنها تتطلب فترة ستة أسابيع لتنخفض نسبة الإنبات فيها إلى ٦٩%، وعند إضافة فضلات الدواجن إلى تربة الحقل كان هنالك تأثير معنوي في خفض نسبة الإنبات للبذور وتقليص فترة البسترة الشمسية من ستة أسابيع إلى أسبوعين.