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## Efficacy of newer insecticide molecules against sesame Jassid (*Orosius albicinctus* Distant) on sesame (*Sesamum indicum*, Linn.) oilseed crop

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### Abstract

A field experiment was carried out on efficacy of newer insecticide molecules against sesame jassid (*Orosius albicinctus* Distant) on sesame (*Sesamum indicum*, Linn.) varieties RT-351 during *kharif* season, 2017. The data revealed that newer insecticides *viz.*, imidacloprid (0.005%) and thiamethoxam (0.025%) were proved most effective and superior over control in reduction of jassid population, followed by dimethoate (0.03%) and acephate (0.037%). The treatment spiromesifen (0.005%) and carbaryl (0.2%) were found least effective against the jassid. The highest seed yield of 7.25 q ha<sup>-1</sup> was recorded in the plots treated with imidacloprid followed by thiamethoxam (7.15 q ha<sup>-1</sup>). The minimum seed yield (5.11 q ha<sup>-1</sup>) was obtained in the plots treated with spiromesifen (0.005%) followed by the treatment carbaryl (5.29 q ha<sup>-1</sup>). On the basis of economics, the highest B: C ratio (11.51:1) was recorded in the treatment of imidacloprid followed by dimethoate (10.66:1), whereas, lowest B: C ratio (3.08:1) was recorded from plots treated with spiromesifen (0.005%).

**Keywords:** Sesame, jassid, newer insecticide, efficacy, imidacloprid and thiamethoxam

### Introduction

Sesame (*Sesamum indicum* Linn.) belongs to family Pedaliaceae which is also known as Til. Sesame plays an important role in human nutrition and Indian culture. It is an important edible oilseed crop cultivated in India and its seeds contain 52- 57 per cent oil and 25 per cent protein (Smith *et al.*, 2000) [15]. Nearly, 78 per cent of the seed produced in India is used for oil extraction, 2.5 per cent for planting purposes and the rest in confections and in religious Hindu ceremonies. In India, the major sesame growing states are Madhya Pradesh, Gujarat, Rajasthan, Uttar Pradesh, Andhra Pradesh, Orissa, Tamil Nadu and Karnataka. Total area of sesame in India is 7.47 lac hectares with annual production of 8.28 lac tonnes and average productivity of 474 kg/ ha (Anonymous, 2016) [5]. In Rajasthan, the crop is grown in an area of 3.66 lac ha with annual production of 1.15 lac tonnes and average productivity of 314 kg/ ha. The main growing districts in the state are Pali, Jodhpur, Sawai Madhopur, Sirohi, Jalore, Bhilwara, Tonk, Karauli, Nagaur, Ajmer, Dausa, Bundi, and Kota (Anonymous, 2017) [6]. Several biotic and abiotic factors are responsible for lower production and productivity of sesame. Among them, insect pests are one of the important limiting factors affecting the production of such an important oilseed crop sesame both in quality and quantity (Egonyu *et al.*, 2005 and Ahirwar *et al.*, 2010) [10, 3]. The pests attack tolls a heavy loss (25 to 90%) in seed yield (Ahuja and Kalyan, 2002) [4]. Among 67 insect pests damaging sesame crop *viz.*, leaf webber and capsule borer, *Antigastra catalaunalis* (Dup.); jassid, *Orosius albicinctus* Distant; whitefly, *Bemisia tabaci* (Genn.); mirid bug, *Nesidiocoris tenuis* (Reuter); til hawk moth, *Acherontia styx* Westwood etc. have been recorded (Ahirwar *et al.*, 2009; Biswas and Das, 2011; Thangjam and Vastrad, 2015) [2, 7, 16]. Among them, nymphs and adults population of jassid are serious sucking insect pests which suck the cell sap from leaves, flowers and pods. Due to this curling of leaf margins downward, reddening of leaf margins, stunted growth of the plants and abnormal growth of the leaf tissue occur. Jassid is also responsible to transmit phyllody diseases in sesame (Ahirwar *et al.*, 2010) [3]. During the recent few years, the population of sucking insect pests created a serious problem to agricultural sector.

Therefore, some workers recommended chemical control to combat with insect pests of sesame but due to toxic nature of chemicals, they posed serious problems of pest resurgence, environmental hazards and insect resistance. In this view there is scope of utilizing the newer insecticide molecules which are required in small quantity to control the pests and are economically feasible, socially adoptable and ecologically acceptable for control of sucking pest jassid (*Orosius albicinctus*) in sesame crop. Keeping in view the above thematic areas, present experiment was carried out to evolve the efficacy of newer insecticide molecules to manage sucking pest jassid of sesame oilseed crop.

### Materials and Methods

With a view to evaluate efficacy of newer insecticide molecules against sucking insect pest jassid (*Orosius albicinctus* Distant) of sesame crop, the present experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (S.K.N. Agriculture University, Jobner) during *Kharif* season, 2017. The experiment was laid out in a simple randomized block design (RBD) with ten treatments viz. Imidacloprid 17.8 SL (0.005%), Thiamethoxam 25 WG (0.025%), Acephate 75 SP (0.037%), Spiromesifen 22.9 SC (0.005%), Emamectin benzoate 5 SG (0.002%), Lambda cyhalothrin 5 EC (0.008%), Dimethoate 30 EC (0.03%), Carbaryl 50 WP (0.2%), Thiacloprid 70 WG (0.025%) and untreated control were used over sesame varieties RT-351. Each treatment was replicated thrice. The individual plot size was 3.0 m x 2.4 m, keeping row to row and plant to plant distance of 30 cm and 10 cm, respectively.

### Application of newer insecticides

All the insecticides were applied as a foliar spray. The spraying was done by using a pre-calibrated foot sprayer. The first insecticidal spray was given on 27th August 2017 and the second after three weeks of first spraying i.e. 18th September, 2017. The quantity of spray solution was 600 litres per hectare in each spray application. The insecticidal solution was prepared according to the following formula.

$$V = \frac{C \times A}{\% a.i}$$

Where,

V = Volume of the insecticide

C = Concentration required

A = Amount of spray solution needed

% a.i. = Percentage of active ingredient of the insecticide

### Observations

The observations on the sesame jassid population were recorded on five randomly selected and tagged plants in each plot. Three leaves, viz., one each from top, middle and lower canopy of the plant were taken into account for recording the jassids (nymphs and adults). The population was recorded regularly one day before application (pre-treatment population) and one, three, seven and 15 days after application (post-treatment population) of insecticides in both the sprays in the early morning hours. The crop was harvested when capsules attained full maturity and seed yield per plot was converted into quintal per hectare and yield data were statistically analysed. Efficacy of different treatment in controlling the sesame jassid was determined by calculating percent reduction with the formula given by Abbott's formula

(1925)<sup>[1]</sup> which is as under:

$$\text{Per cent control (Reduction)} = \frac{X - Y}{X} \times 100$$

Where,

X = Number living in the check

Y = Number living in the treated

X - Y = Number killed by the treatment

The statistical analysis (analysis of variance) of the data was carried out by transforming the percentage data into angular transformation values (Gomez and Gomez, 1976)<sup>[11]</sup>. The increase in yield of grain over control (untreated) was calculated for each treatment. To determine the most effective and economical treatment, the net profit and benefit cost ratio was worked out by taking the expenditure on individual insecticide treatment and the corresponding seed yield into account. The economics of various treatments was also worked out by computing the cost of insecticides as well as their cost of application. The gross income was worked out by multiplying the seed yield with the wholesale price of sesame prevailing in the market at the time of threshing.

### Results and Discussion

#### Efficacy of newer insecticide against sesame jassid (*O. albicinctus*) after first spray

Data presented in table 1 indicated that all the treatments were found significantly superior over the untreated control one day after application. The results revealed that the maximum reduction in jassid population (88.74%) was recorded in imidacloprid 0.005 per cent treatment which was at par with thiamethoxam 0.025 per cent which resulted 87.89 per cent reduction (table 1). However, these treatments were found significantly superior over rest of the treatments. The minimum reduction of 44.31 per cent was recorded in plots treated with spiromesifen 0.005 per cent and it was at par with carbaryl 0.2 per cent (49.15%) and both were proved significantly inferior over rest of the insecticidal treatments. The descending order of effectiveness of insecticides one day after treatment was found to be: Imidacloprid > Thiomethoxam > Dimethoate > Acephate > Lambda cyhalothrin > Emamectin benzoate > Thiacloprid > Carbaryl > Spiromesifen. The per cent reduction in jassid population after three days of insecticidal application was reached at highest position in all the treatments and proved significantly superior over control, the maximum reduction (95.58%) in jassid population after three days of spraying was recorded from the treatment imidacloprid 0.005 per cent followed by thiamethoxam 0.025 per cent (92.77%), however both the treatment were statistically at par. The minimum reduction of 59.91 per cent jassid population was recorded with the treatment of spiromesifen 0.005 per cent and it was at par with carbaryl 0.2 per cent (63.53%). The descending order of effectiveness of insecticides three days after treatment was found similar to one day of application of insecticides.

After seven days of application, all the insecticidal treatments proved significantly superior in reducing the population of jassid in the field. The maximum reduction (88.58%) was recorded in the treatment of imidacloprid 0.005 per cent, which, was at par with thiamethoxam 0.025 per cent that gave 84.06 per cent reduction in jassid population. The minimum reduction of jassid population were resulted by spiromesifen 0.005 per cent (62.02%) followed by carbaryl 0.2 per cent

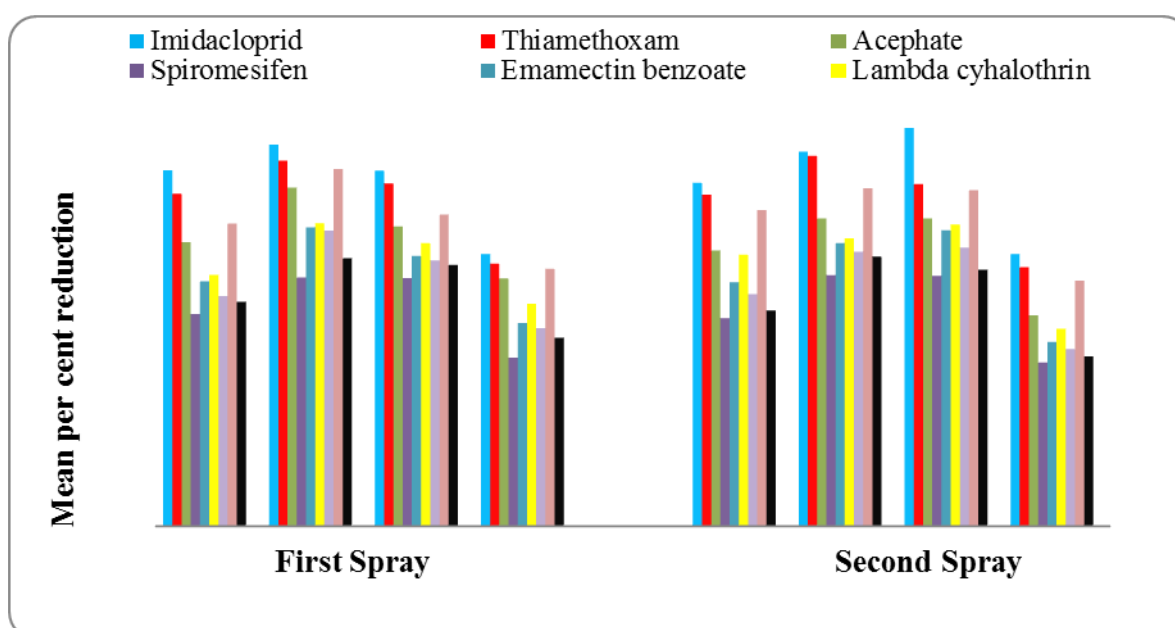
(63.75%) and thiacloprid 0.025 per cent (65.67%), which were found statistically at par with each other. The descending order of effectiveness of insecticides seven days after treatment was found to be Imidacloprid > Thiomethoxam > Dimethoate > Acephate > Lambda cyhalothrin > Emamectin benzoate > Thiacloprid > Carbaryl > Spiromesifen. After fifteen days of application of insecticides, the maximum reduction in jassid population was found in treatment of imidacloprid 0.005 per cent (68.26%) followed by thiamethoxam 0.025 per cent (67.06%) and

dimethoate 0.03 per cent (63.65%), however, these treatments have non-significant difference in relation to reduction of jassid population. The minimum reduction of jassid population was recorded in the treatment of spiromesifen 0.005 per cent (39.93%) followed by carbaryl 0.2 per cent (44.37%), which were found statistically at par with each other, and both were found significantly inferior to rest of the other treatments. The descending order of effectiveness of insecticides fifteen days after treatment was found similar to 1, 3 and 7 days of application of insecticides.

**Table 1:** Efficacy of different newer insecticides against sesame jassid (*Orosius albicinctus* Distant.) and seed yield of sesame

S. No.	Insecticides	Formulation	Concentration (%)	Mean per cent reduction after								Mean yield (q ha <sup>-1</sup> )
				1 <sup>st</sup> spray				2 <sup>nd</sup> spray				
				One day	Three days	Seven days	Fifteen days	One day	Three days	Seven days	Fifteen days	
1.	Imidacloprid	17.8 SL	0.005	88.74 (70.39)	95.58 (77.86)	88.58 (70.25)	68.26 (55.71)	84.52 (66.83)	93.25 (74.95)	82.32 (65.13)	63.05 (52.56)	7.25
2.	Thiamethoxam	25 WG	0.025	87.89 (69.64)	92.77 (74.40)	84.06 (66.47)	67.06 (54.98)	83.59 (66.10)	89.70 (71.28)	79.85 (63.33)	59.26 (50.33)	7.15
3.	Acephate	75 SP	0.037	75.06 (60.04)	78.89 (62.63)	75.30 (60.20)	61.43 (51.61)	67.03 (54.96)	77.57 (61.73)	74.08 (59.39)	50.81 (45.46)	6.42
4.	Spiromesifen	22.9 SC	0.005	44.31 (41.73)	59.91 (50.72)	59.50 (50.47)	39.93 (39.19)	50.46 (45.26)	60.71 (51.18)	59.85 (50.68)	36.95 (37.44)	5.11
5.	Emamectin benzoate	5 SG	0.002	57.26 (49.18)	72.29 (58.24)	70.78 (57.28)	54.61 (47.64)	59.75 (50.62)	68.63 (55.94)	68.44 (55.82)	44.57 (41.88)	6.02
6.	Lambda cyhalothrin	5 EC	0.008	62.35 (52.15)	77.44 (61.64)	73.44 (58.98)	60.24 (50.91)	60.84 (51.26)	72.01 (58.06)	73.38 (58.94)	46.19 (42.81)	6.37
7.	Thiacloprid	70 WG	0.025	55.07 (47.90)	67.14 (55.02)	65.47 (54.01)	52.22 (46.27)	54.64 (47.66)	66.27 (54.50)	65.78 (54.20)	41.57 (40.15)	5.37
8.	Dimethoate	30 EC	0.03	78.21 (62.17)	89.81 (71.39)	77.59 (61.74)	63.65 (52.92)	73.45 (58.98)	82.12 (64.99)	78.52 (62.39)	52.37 (46.35)	6.59
9.	Carbaryl	50 WP	0.2	49.15 (44.51)	63.53 (52.85)	63.75 (52.98)	44.37 (41.77)	51.55 (45.89)	61.54 (51.67)	64.64 (53.51)	39.95 (39.20)	5.29
10.	Control	-	-	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	3.53
	S.Em. ±	-	-	1.04	1.30	1.39	1.20	1.37	1.27	1.11	1.27	0.12
	CD (p=0.05)	-	-	3.08	3.87	4.12	3.55	4.06	3.76	3.30	3.77	0.35

Figures in the parentheses are angular transformation values



**Fig. 1:** Efficacy of different newer insecticides against jassid (*Orosius albicinctus* Distant.) on sesame

#### Efficacy of newer insecticide against sesame jassid (*O. albicinctus*) after second spray

All the treatments were found significantly superior one day

after application of insecticides over the untreated control. However, there existed a considerable difference in between the different insecticidal treatments (Table 1). The maximum

reduction in jassid population (84.52%) was recorded in the treatment imidacloprid 0.005 per cent, which, was at par with thiamethoxam 0.025 per cent (83.59%), however, these treatments were found significantly superior over rest of the treatments. The minimum reduction (50.46%) was recorded in plots treated with spiromesifen 0.005 per cent followed by carbaryl 0.2 per cent (51.55%) and thiacloprid 0.025 per cent (54.64%) were found at par with each other. All the insecticidal treatments were found significantly superior in reducing the jassid population over untreated control after three days of treatment and the per cent reduction was ranged from 60.71 to 93.25 per cent. The maximum reduction of jassid population was recorded in the treatment imidacloprid 0.005 per cent (93.25%) followed by thiamethoxam 0.025 per cent with 89.70 per cent reduction. The minimum reduction (60.71%) was recorded in the treatment of spiromesifen 0.005 per cent followed by carbaryl 0.2 per cent (61.54%) and thiacloprid 0.025 per cent (66.27%), which were at par with each other in respect to reduction in jassid population.

The per cent reduction after seven days of insecticidal application got decreased with the similar trend and proved significantly superior over control where the mean per cent reduction was ranged from 63.31 to 82.32 per cent. The maximum reduction of 82.32 per cent was found in the treatment imidacloprid 0.005 per cent followed by thiamethoxam 0.025 per cent and dimethoate 0.03 per cent resulted into 79.85 and 78.52 per cent reduction in jassid population, respectively, however, no significant difference among themselves. The minimum reduction of jassid population was recorded in the treatment of spiromesifen 0.005 per cent (63.31%) followed by carbaryl 0.2 per cent (64.64%), thiacloprid 0.025 per cent (65.78%) and emamectin benzoate 0.002 per cent (68.44%), these were found at par with each other. After fifteen days of application of insecticides, it was observed that the per cent reduction of jassid population was gradually decreased. The 63.05 per cent reduction in jassid population was recorded in the treatment imidacloprid 0.005 per cent, which was at par with thiamethoxam 0.025 per cent (59.26%). The minimum reduction of 36.95 per cent was recorded in the treatment of spiromesifen 0.005 per cent followed by carbaryl 0.2 per cent (39.95%) and thiacloprid 0.025 per cent (41.57), these three have no significant difference in reduction of jassid population. The descending order of effectiveness of insecticides 1, 3, 7 and 15 days after treatment was found similar i.e. Imidacloprid > Thiamethoxam > Dimethoate > Acephate > Lambda cyhalothrin > Emamectin benzoate > Thiacloprid > Carbaryl > Spiromesifen.

The present findings are in agreement with the report of Choudhary (2009)<sup>[8]</sup> who reported that the imidacloprid 17.8 SL (0.005%) was the most effective insecticide in suppression of jassid population on sesame crop. Pachundkar *et al.* (2013)<sup>[13]</sup> and Das and Islam (2014)<sup>[9]</sup> observed that the efficacy of

imidacloprid 70 WG (0.015% and 0.2g/ lit, respectively) was found effective in reduction of jassid population on cluster bean and brinjal crop, respectively, also support the present findings. Pachundkar *et al.* (2013)<sup>[13]</sup> also reported that thiacloprid 48 SC (0.012%) was found moderately effective against jassid on cluster bean crop. The results are in conformity with the findings of Choudhary (2009)<sup>[8]</sup>, who reported that carbaryl 0.2 per cent was found least effective in reducing the jassid population on sesame crop. The findings are in partial conformity with that of Kharel *et al.* (2016)<sup>[12]</sup>, who observed that spiromesifen 240 SC (150g a.i./ ha) was effective in reduction of jassid population on green gram crop.

#### Effect of newer insecticides on the seed yield of sesame

The data presented on the table 1 revealed that all the plots treated with insecticides gave significantly higher seed yield over control (3.53 q ha<sup>-1</sup>). The maximum seed yield of 7.25 q ha<sup>-1</sup> was obtained in the plots treated with imidacloprid 0.005 per cent followed by thiamethoxam 0.025 per cent (7.15 q ha<sup>-1</sup>), however, both the treatment yields were statistically at par with each other. The minimum seed yield of 5.11 q ha<sup>-1</sup> was obtained in the plots treated with spiromesifen 0.005 per cent followed by the treatment carbaryl 0.2 per cent (5.29 q ha<sup>-1</sup>) and thiacloprid 0.025 per cent (5.37 q ha<sup>-1</sup>), which was found statistically at par with each other. The order of effectiveness of insecticides on the basis of seed yield was found to Imidacloprid > Thiamethoxam > Dimethoate > Acephate > Lambda cyhalothrin > Emamectin benzoate > Thiacloprid > Carbaryl > Spiromesifen. These findings are in agreement with the results of Choudhary (2009)<sup>[8]</sup> who found that the lowest seed yield of sesame was obtained from the carbaryl (0.2%) treatment.

#### Economics of insecticidal treatments

The maximum profit was recorded from the plots treated with imidacloprid 0.005 per cent which gave a benefit: cost ratio of 11.51:1 (Table 2). It was followed by dimethoate 0.03 per cent and acephate 0.037 per cent, which resulted in a benefit: cost ratio of 10.66:1 and 9.98:1, respectively. The lowest benefit: cost ratio of 3.08:1 was recorded from plots treated with spiromesifen 0.005 per cent followed by carbaryl 0.2 per cent (3.28:1) and thiacloprid 0.025 per cent (5.77:1). The results of benefit cost ratio are in compliance with that of Pandey *et al.* (2018)<sup>[14]</sup>, who reported that the treatment imidacloprid 70 WS (Seed treatment) + foliar spray of imidacloprid 17.8 SL (0.25 ml/ l) had maximum benefit: cost ratio (4.22:1), while, the treatment imidacloprid 70 WS (Seed treatment) + foliar spray of thiacloprid (1.0 ml/ ha) and imidacloprid 70 WS (Seed treatment) + foliar spray of lambda cyhalothrin (1.0 ml/ ha) gave benefit: cost ratio of 3.72:1 and 3.36:1, respectively on sesame crop. These results are also similar with the results of Choudhary (2009)<sup>[8]</sup> who found that the treatment carbaryl (0.2%) gave lowest benefit: cost ratio (1.51:1).

**Table 2:** Comparative economics of newer insecticides on sesame

S. No	Treatments	Formulation	Conc. (%)	Mean yield (q ha <sup>-1</sup> )	Increased yield over control (q ha <sup>-1</sup> )*	Cost of increased yield (Rs ha <sup>-1</sup> )*	Total cost of management (Rs ha <sup>-1</sup> )**	Net return (Rs ha <sup>-1</sup> )	Benefit cost ratio
1.	Imidacloprid	17.8 SL	0.005	7.25	3.72	26040	2081	23959	11.51
2.	Thiamethoxm	25 WG	0.025	7.15	3.62	25340	2772	22568	8.14
3.	Acephate	75 SP	0.037	6.42	2.89	20230	1841	18389	9.98
4.	Spiromesifen	22.9 SC	0.005	5.11	1.58	11060	2710	8350	3.08
5.	Emamectin benzoate	5 SG	0.002	6.02	2.49	17430	1826	15604	8.55
6.	Lambda cyhalothrin	5 EC	0.008	6.37	2.84	19880	2066	17813	8.62



7.	Thiacloprid	70 WG	0.025	5.37	1.84	12880	1904	10977	5.77
8.	Dimethoate	30 EC	0.03	6.59	3.06	21420	1836	19584	10.66
9	Carbaryl	50 WP	0.02	5.29	1.76	12320	2892	9428	3.26
10.	control	-	-	3.53	-	-	-	-	-
	S.Em. $\pm$	-	-	0.12	-	-	-	-	-
	CD (p=0.05)	-	-	0.35	-	-	-	-	-

\* Cost of seed of sesame at prevailing market price at the time of threshing, *i.e.* Rs. 7000 q<sup>-1</sup>

\*\* It includes cost of insecticides and labour charges @ Rs. 242/ labour/ day (3 labours / spray/ ha.)

## Conclusion

In conclusion, according to the findings of the present experiment, imidacloprid 0.005 per cent followed by thiamethoxam 0.025 per cent showed excellent results against the sesame jassid population, while spiromesifen 0.005 per cent proved as least effective. The highest seed yield of sesame was obtained in the treatment imidacloprid 0.005 per cent having maximum benefit-cost ratio. Hence, the newer insecticide molecules with short residual effect, high benefit-cost ratio and low adverse effect on the environment could be suggested for the management of *Orosius albicinctus* Distant on sesame oilseed crop production.

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