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Protection Elements for Safflower Oilseeds

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Abstract

Agricultural techniques for growing safflower, adaptive to the natural and climatic zone, is an important and necessary measure for increasing yields and improving the quality of oil seeds of safflower (*Carthamus tinctorius* L). Biological and morph physiological characteristics of the culture and its variety determine the technological methods for its cultivation and production of oil seeds. Safflower is a crop that is of great value and is able to replace sunflower. The agricultural technology of its cultivation in the Lower Volga region is constantly being studied; however, safflower plant protection methods are not well understood. Experiments to study the effectiveness of safflower protection methods were carried out in 2017-2019 on the territory of the experimental field of the Federal Research Center for Agro-Ecology of the Russian Academy of Sciences, where light chestnut soils with a humus content of 1.2-2.0% and pH = 7.8 predominate. Ways of protecting safflower were considered and the effectiveness of seed dressing with a mixture of Vincit 1.5 l/t + Fertigrain Start 0.5 l/t was revealed. This option was the most profitable (16.5%), with a yield of 1.2 t/ha. The control option using a mixture of Vincit + Azotovit + Phosphatovit 1.5 l/t + 2.2 l/t + 2.2 l produced a yield of 0.8 t/ha and was not profitable.

Keywords: agricultural technology, safflower, productivity, oil content of seeds, plant protection, root rot, pesticides, agrochemicals.

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1. Introduction

Agro technical measures are the basis for the cultivation of safflower and the production of its oilseeds, for the production of oil, which has an oil content of 25-32%. Safflower is grown in arid areas where it is able to replace sunflower [1–3].

Safflower is a heat-loving plant and a very drought-tolerant plant, it is especially demanding of heat in the flowering and ripening phases. However, it is able to withstand frosts to -5-6°C. Safflower doesn't demand the soil, it grows in saline soil and form oilseed crops [2, 4, 5].Damp and cloudy weather for its growth and development is extremely unfavorable, since its flowers are not fertilized, and the baskets

rot. In our studies, SCC during the study period for the growing season averaged 0.6; precipitation fell during the growing season 202.3 mm [6.7], which is typical for dry conditions and favorable for growing safflower.

To date, a lot of scientific articles have been published on scientific articles devoted to safflower agrotechnics, but there are a small number of publications devoted to the protection of safflower crops.

Modern technologies for the use of safflower allow its use in the food and pharmaceutical industries as raw materials for the manufacture of varnishes of paints and their use in construction [8, 9].

2. Methods and Equipment

2.1. Conditions of experiment

The studies were carried out on the experimental field located in the light chestnut subzone of the dry steppe zone of chestnut soils. The climate is sharply continental. The sum of average daily positive air temperatures is 3400-3500℃. The humus content is 1.2-2.0%, pH = 7.8. Total precipitation for the study period 2017-2019 557 mm fell from sowing to harvesting safflower. The average daily air temperature during the study period during the growing season was 22.8°C. In the studies, the safflower variety Alexandrite was sown, which has good drought resistance and heat resistance. The variety was obtained by individual selection from the collection sample of VNIIR.

2.2. The methods of research

Field experience laid in accordance with the recommendations of B.A. Dospechov4x repetition. The area of the accounting plot is 72m^2. Agrotechnics for growing safflower is generally accepted for this region.

2.3. The purposes of research

The purpose of this research is new knowledge about safflower plant protection methods in integrated plant protection systems using new generation pesticides and agrochemicals in light chestnut soils of the Volgograd region. The research program provides for the solution of the following tasks:

1. to assess the impact of the use of pesticides and agrochemicals of a new generation on the phytosanitary condition of safflower crops;

2. to consider the effectiveness of the impact of drugs on changing the structure of the crop and increasing the yield and quality of safflower oil seeds;

3. to conduct an economic assessment of the complex effect of pesticides and agrochemicals of a new generation on safflower productivity in the Lower Volga region.

3. Results and Discussion

In studies for the intended purposes, various options for the use of pesticides against the background of dumping the soil and sowing the seeds of safflower varieties Alexandrite were included there.

The scheme of experiment:

Variant

(cultivation of oilseeds.)

1. Control (v/0).

2. Vincit 2.0 l/t

3. Vincit1.5 l/t+FertigreinStart 0.5 l/t

4. Vincit 1,5 l/t +Azotovit 2.2 l/t + Phosphatofit 2.2 l/t

The best germination energy (86.0%) and germination (87.0%) were observed in safflower plants, where the seeds were treated with a chemical fungicide mixed with fertilizers: Vincit 1.5 l / t + Fertigrain Start 0.5 l / t (option 3), this is 3.7% more - germination energy, and germination better than 6.1% is better (table 1).

Table 1: Energy of germination of safflower, 2017-2019 (laboratory experience)

№ var.	Variant (seed treatment type)	Energy of germination, %	Growth,%
V-1	Control (v/0).	81	82
V-2	Vincit (cultivation of seeds) 2.0 l/t.	80	83
V-3	Vincit+ Fertigrain Start 1.5 l/t+ 0.5 l/t	**86**	**87**
V-4	Vincit + Azotovit + Phosphatovit 1.5 l/t+ 2.2 l/t+ 2.2 l/t.	84	86

The use of fungicide Vincit in a dosage of 1.5 l / t with fertilizers Fertigrain Start 0.5 l / t had a positive effect on safflower plants, and the development of root rot on average was 1.2%, while on option №1, where the seeds were treated with water, development was 3.9% (outlet phase), distribution in version 3 2.8, and in the control version without treatment 7.9% (table 2). Further, at the beginning of grain maturation, the infection was

restrained, and the development of root rot was 17.3%, which is 11.9% lower in the first embodiment, and their distribution is also 22.1% less.

Table 2: Damage to safflower plants by root rot,2017-2019,%

№ Var.	Variants	Ianalysis (first phase)		II analysis (the beginning of growing seed)	
		development, % (P_B)	spreading, % (P)	development, % (P_B)	spreading, % (P)
1	Control (v/o).	3.9	7.9	29.2	47.6
2	Vincit(cultivation of oilseeds) 2.0 l/t.	1.3	3.2	21.5	37.6
3	Vincit + Fertigrade Start 1.5l/t+ 0.5 l/t	1.2	2.8	17.3	25.5
4	Vincit + Azotovit + Phosphatophit 1.5 l/t+ 2.2 l/t+ 2.2 l/t.	1.3	3.0	22.9	35.2

Structural analysis of safflower showed a positive effect of chemicals and growth regulators on the number of branches, the number of bolls, the weight of 1000 grains, etc. The best yield indicators were shown by option №3 (Vincit 2.0 l / t + Fertigrain Start 0.5 l / t), and in comparison with option No. 1 (control b / o) prevailed by 0.4 t / ha (table 3). The number of boxes was 11.3 pcs / m^2, and in the control variant it was 8.6 pcs / m2, the number of grains in the best version was 191.4, which is 64.2 more. The weight of 1000 grains in version 3 was 42 g, in the control version 0.6 g less.

Table 3: Structural analysis of safflower, 2017-2019

№ Var.	Variants	Weigh of knots, g	Quantity of flowers, th./$m^{2.}$	Height of steeble.	Quantity of boxes th./$m^{2.}$	Quantity of branches th.	Figure of seed from one растения	mass 1000 seeds, g	crops, t/ga
1	Control (v/o).	378	14.8	89.6	8.6	10.2	127.2	41.4	0.8
2	Vincit (cultivation of oilseeds) 2.0 l/t.	427	12.8	101.1	10.9	10.9	208.7	42.2	1.1
3	Vincit + Fertigrade Start 1.5l/t+ 0.5 l/t	428	14.8	111	11.3	12.8	191.4	42.0	1.2
4	Vincit + Azotovit + Phos-phatophit 1.5 l/t + 2.2 l/t + 2.2 l/t.	405	15.8	89.6	8.8	10.3	174.9	42.6	0.9

An analysis of the quality of safflower grain showed that the use of various drugs did not adversely affect the biochemical processes in plants. The predominant among the options were on average the B-3.4 protein content (15, 9; 15, 1%), while the B-1 control was 13.3% (for the protein). The maximum oil content in safflower seeds was 24.51% in

the second variant, 24.26% in the third one, in comparison with the control: the second variant was 2.97% more, the third one was 2.72% more (see table 4).

Table 4: Qualitative indicators of safflower oilseeds, 2017-2019.

№ Var.	Variants	protein, %	Oil, %
1	Control (v/o).	13.3	21.54
2	Vincit(cultivation of oilseeds) 2.0 l/t.	14.75	**24.51**
3	**Vincit + Fertigrade Start 1.5l/t+ 0.5 l/t**	**15.9**	**24.26**
4	Vincit + Azotovit + Phosphatophit 1.5 l/t + 2.2 l/t + 2.2 l/t.	**15.1**	23.19

Our calculations showed that option №3 (Vincit + Fertigrain Start 1.5 l / t + 0.5 l / t) was the most cost-effective; its profitability was 16.5%, compared to the second by 7%. The first option without the use of pesticides and option № 4 (Vincit + Azotovit + Phosphatovit 1.5 l / t + 2.2 l / t + 2.2 l/t) were not profitable (see table 5).

Table 5: Cost-effectiveness of safflower cultivation, 2017-2019.

Features	measurement	Variants			
		v-1	v-2	v-3	v-4
Yield	t/ha	0,8	1,1	1,2	0,9
Price of realization	rub.	13000.0	13000.0	13000.0	13000.0
Revenue	rub./ ha	10400	14300	15600	11700
Wastes	rub./ ha	11480.0	13360	13385	13473
Net income	rub./ ha	-1080	940	2215	-1773
Rentability	%	-	7	16.5	-

4. Conclusion

1. The best germination energy (86.0%) and germination (87.0%) was observed in safflower plants, where the seeds were processed before sowing with a chemical fungicide mixed with fertilizers: Vincit 1.5 l/t + Fertigrain Start 0.5 l/t (option №3);

2. The use of fungicide Vincit in a dosage of 1.5 l/t with fertilizers Fertigrain Start 0.5 l/t had a positive effect on safflower plants, and the development of root rot on average was 1.2%, while on option № 1., where the seeds were treated with water, the development was 3.9%;

3. The best indicators of biological productivity were shown by option №3 (Vincit 2.0 l/t + Fertigrain Start 0.5 l/t) - 1.2 t/ha;

4. The best quality safflower oilseeds in the variants were on average the B-3.4 protein content (15.9; 15.1%), the second option was 24.51% by oil content, the third option was 24.26 in second place, %;

5. The economic profitability of growing safflower oil seeds was in the third option - 16.5%.Thus, evaluating the effect of the use of pesticides and agrochemicals of a new generation on the phytosanitary state of safflower crops, it can be concluded as having a positive effect on the containment of the pathogenic infection that causes safflower fungal diseases. The use of pesticides and agrochemicals of a new generation has a positive effect on changing the structure of the crop and increasing the yield and quality of safflower oil seeds. The most cost-effective way to use pesticides and agrochemicals of a new generation, using Vintsit + Fertigrain Start in tank mixtures of 1.5 l/t + 0.5 l/t when dressing seeds before sowing for safflower yield using the adaptive variety Alexandrite - 16.5%.

Conflict of Interest

The authors have no conflict of interest to declare.

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