

EFFECTIVENESS OF FUSILADE AND KUSAGARD IN THE CONTROL OF JOHNSONGRASS FROM SEEDS AND RHIZOMES IN SUNFLOWER CROPS

N. ȘARPE, C. DINU

Research Institute for Cereals
and Industrial Crops,
8264 Fundulea, Romania

The herbicides with selectivity in sunflower, developed up to the present time in the world, only achieve the control of annual gramineous species such as *Setaria* spp., *Echinochloa crus-galli*, *Digitaria sanguinalis*, etc.

Some herbicides such as those containing trifluralin, butylate, EPTC+antidote, ethalfluralin, profluralin, etc., are only able to control Johnsongrass emerged from seeds. For this reason, the crops are readily reinfested by the weed emerged from rhizomes (Lubenov, 1975; Șarpe et al., 1975).

Johnsongrass infestations have become extensive in Romania, in particular in the irrigated areas of the dammed flooded plain of the Danube and in western Banat. Under such circumstances, sunflower yields are diminished by more than 30—50% even if the crops are treated with Gesagard 50 or Triflurom+Gesagard 50.

The recent development of new selective herbicides such as Fusilade, Kusagard, etc., capable to control *Sorghum halepense* emerged from seeds and rhizomes also opens new prospects in the technology of sunflower cultivation. The first trials with Fusilade and Kusagard conducted for this purpose in 1980 and 1981 at Fundulea are reported in the present paper.

METHODS

The experiments were carried out on medium-leached chernozem soil with 3.5% humus and 36% clay, heavily infested by *Sorghum halepense* from seeds and rhizomes.

The following herbicides were tested:

- Fusilade, containing 25% fluazifop-butyl;
- Kusagard, containing 75% alloxidim-sodium;
- Gesagard 50 WP, containing 50% prometryn.

In the previous years, immediately after sunflower was planted, all variants received a uniform rate of Gesagard 50 WP of 6 kg/ha with a view to controlling the annual dico-

tyledonous weeds (*Sinapis arvensis*, *Amaranthus* spp., *Chenopodium* spp.), in particular those known as resistant to fluazifop-butyl and alloxidim-sodium.

Fusilade and Kusagard were applied postemergence, i.e. at the time when Johnsongrass seedlings grown from seeds were in the early tillering stage. At this time the height of Johnsongrass plants grown from rhizomes ranged from 10—15 cm to 20—30 cm.

Observations and ratings were made according to the EWRS scale for sunflower growth and development and for effectiveness of the control of Johnsongrass emerged from seeds and rhizomes. Seed yield was estimated at harvesting.

RESULTS

Fusilade and Kusagard being tested for the first time in sunflower crops, a special emphasis was laid on the selectivity level recorded in terms of the rate of application and, therefore, observations and ratings were made at 10—15 day intervals after the treatment. The results obtained in both years are included in Table 1.

The first observation was made 10 to 15 days after the postemergence application of Fusilade and Kusagard; no phytotoxicity symptoms were detected. In all variants receiving Fusilade and Kusagard, irrespective of the rates tested, the height and leaf colour of sunflower plants was the same as in the untreated check plots. The results are in agreement with the findings of Plowman et al. (1980) and Stonebridge (1981) that Fusilade is also highly selective in sunflower plants.

The data related to the effectiveness of the two herbicides in the control of Johnsongrass from seeds and rhizomes are of a particular importance. The results obtained over 2 years of testing reveal a clear difference in the mode of action of these herbicides on the Johnsongrass plants (Table 2).

Table 1

Selectivity of Fusilade and Kusagard in sunflower plants

Herbicides tested	Rate per hectare	EWRS rating after treatment in					
		1980			1981		
		10 days	22 days	60 days	15 days	30 days	60 days
Check I, hoed 3 times	—	1.0	1.0	1.0	1.0	1.0	1.0
Check II, inhoed	—	1.0	1.0	1.0	1.0	1.0	1.0
Fusilade	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Fusilade	3.0	1.0	1.0	1.0	—	—	—
Fusilade	4.0	1.0	1.0	1.0	1.0	1.0	1.0
Fusilade	6.0	1.0	1.0	1.0	—	—	—
Fusilade	8.0	—	—	—	1.0	1.0	1.0
Kusagard	1.5	1.0	1.0	1.0	—	—	—
Kusagard	2.0	—	—	—	1.0	1.0	1.0
Kusagard	3.0	1.0	1.0	1.0	1.0	1.0	1.0
Kusagard	4.0	—	—	—	1.0	1.0	1.0
Kusagard	6.0	—	—	—	1.0	1.0	1.0

EWRS rating: 1 = free of phytotoxicity symptoms
9 = 95–100% of the sunflower plants destroyed.

From Table 2 it results that in both years *S. halepense* was the prevailing species. Due to the sufficient rainfalls recorded at the end of April, Gesagard applied immediately post-planting had a good effect in the control of annual weeds such as *Setaria* spp., *Echinochloa crus-galli*, *Sinapis arvensis* and *Amaranthus* spp. The species *Convolvulus arvensis* and *Cirsium arvense* were present in low numbers and, therefore, were not considered.

With regard to the control of Johnsongrass, it was found that both Fusilade and Kusagard were effective against the seedlings which at the time of the application had emerged. A reinfestation occurred 30 to 40 days later as a result of the rainfalls, new plants emerging from seeds which until autumn formed heads bearing unripened seeds. It should be mentioned that the infestation with Johnsongrass from seeds was far milder than that with Johnsongrass from rhizomes. In this respect, the results are very important since it was found that in the variants receiving Fusilade at rates above 3 liters/ha the weed plants which emerged from rhizomes turned red a few days after the treatment, gradually dried and were not able to regenerate until Sep-

Table 2

Effectiveness of Fusilade and Kusagard in the control of Johnsongrass emerged from seeds and rhizomes in sunflower crops

Prevailing weed species in order of their frequency:									
In 1980					In 1981				
1. <i>Sorghum halepense</i> 95%					1. <i>Sorghum halepense</i> 90%				
2. <i>Sinapis arvensis</i>					2. <i>Sinapis arvensis</i>				
3. <i>Echinochloa crus-galli</i>					3. <i>Xanthium strumarium</i>				
4. <i>Setaria</i> sp.					4. <i>Echinochloa crus-galli</i>				
5. <i>Amaranthus retroflexus</i>					5. <i>Convolvulus arvensis</i>				
6. <i>Aristolochia clematitis</i>					6. <i>Cirsium arvense</i>				
7. <i>Convolvulus arvensis</i>									
8. <i>Cirsium arvense</i>									
9. <i>Hibiscus trionum</i>									

Herbicides tested *	Rate per ha	In 1980				In 1981			
		Johnsongrass control, %				Johnsongrass control, %			
		from seeds		from rhizomes		from seeds		from rhizomes	
		June	August	June	August	June	25 sept.	June	25 sept.
Check 1—2, hoed twice	—	100	80	100	76	100	80	100	75
Check II, unhoed	—	0	0	0	0	0	0	0	0
Fusilade	2.0	90	60	82	75	95	75	80	75
Fusilade	3.0	100	85	100	94	—	—	—	—
Fusilade	4.0	100	90	100	100	100	80	100	100
Fusilade	6.0	100	90	100	100	—	—	—	—
Fusilade	8.0	—	—	—	—	100	80	100	100
Kusagard	1.5	95	60	60	30	—	—	—	—
Kusagard	2.0	—	—	—	—	100	50	60	20
Kusagard	3.0	100	80	90	40	—	—	—	—
Kusagard	4.0	—	—	—	—	100	60	80	20
Kusagard	6.0	—	—	—	—	100	65	90	30

* All variants receiving Fusilade and Kusagard were first treated (postplanting) with Gesagard 50 WP at 6 kg/ha.

tember. A complete control was thus obtained. In the variants treated with Kusagard, the Johnsongrass plants emerged from rhizomes turned red and then dried partly. At about 30 to 40 days after the treatment new plants appeared from the rhizomes and until in autumn formed ears and physiologically ripened seeds. For this reason, the control in all plots treated with Kusagard was rated as far less effective than in the plots treated with Fusilade. The differences in the effectiveness of these herbicides could be ascribed to the fact that the active ingredient of Fusilade is more readily translocated in rhizomes, whereas with Kusagard translocation is far slower.

The seed yields were closely correlated to the degree of control, as shown in Table 3.

Table 3

Seed yields of sunflower plants treated with Fusilade and Kusagard

Herbicides tested *)	Rate per hectare	1980		1981	
		kg/ha	%	kg/ha	%
Check I, hoed twice	—	2,400	100	1,900	100
Check II, unhoed	—	1,200	52	285	15
Fusilade	2.0	2,100	88	1,330	70
Fusilade	3.0	2,530	106	—	—
Fusilade	4.0	2,600	108	2,470	130
Fusilade	6.0	2,873	120	—	—
Fusilade	8.0	—	—	2,659	132
Kusagard	1.5	1,470	61	—	—
Kusagard	2.0	—	—	380	20
Kusagard	3.0	1,750	73	—	—
Kusagard	4.0	—	—	760	40
Kusagard	6.0	—	—	1,140	60

LD 5%

LD 1%

LD 0.1%

*) All variants receiving Fusilade and Kusagard were first treated (immediately after planting) with Gesagard 50 WP at the rate of 6 kg/ha.

During the vegetation period the plots treated with herbicides were not hoed.

Due to the better effectiveness of the control of Johnsongrass from rhizomes, in all variants receiving Fusilade at rates above 3 liters/ha the yields were distinctly higher than in the variants treated with Kusagard.

CONCLUSIONS AND RECOMMENDATIONS

1. Fusilade and Kusagard applied postemergence at rates ranging between 1.5 and 8 liters/ha were highly selective, no traces of phytotoxicity being observed.

2. Both herbicides showed a good effectiveness in the control of Johnsongrass emerged from seeds. All plots treated with Fusilade and Kusagard were reinfested by Johnsongrass emerged from seeds.

3. Fusilade was more effective than Kusagard in the control of Johnsongrass emerged from rhizomes. In the plots treated with Fusilade at rates ranging between 3 and 8 litres/ha, a 100% control of Johnsongrass plants grown from rhizomes was achieved, as the weeds dried completely and failed to regenerate until autumn.

In the plots treated with Kusagard, Johnsongrass plants emerged from rhizomes dried partly, but later formed new shoots which headed and formed ripened seeds until autumn.

4. The herbicide Fusilade at 3 litres/ha is recommended for application in practice. The application should be made after sunflower emergence, irrespective of its growth stage, when Johnsongrass plants emerged from seeds or rhizomes are 10 to 30 cm tall.

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EFFICACITÉ DES HERBICIDES FUSILADE ET KUSAGARD DANS LA LUTTE CONTRE SORGHUM HALEPENSE PROVENANT DES GRAINES ET DES RHIZOMES DANS LES CULTURES DE TOURNESOL

Résumé

Au cours des dernières années, *Sorghum halepense* est devenue l'espèce adventice dominante dans les zones de la plaine du Danube situées à l'ouest du Banat, qui diminue les productions de tournesol de 30 à 50%. Les herbicides tels que prometryne et trifluralin, utilisés à présent, ne résolvent que partiellement le problème de cette mauvaise herbe, car les plantes issues des rhizomes ne sont pas détruites.

Afin de contribuer à la lutte contre *S. halepense*, les auteurs ont effectué en 1980 et 1981 à Fundulea les premiers essais avec les nouveaux herbicides sélectifs Fusilade et Kusagard, appliqués en post-lévée à des doses de 1,5—8 litres/ha, qui ont présenté une très bonne sélectivité pour le tournesol.

Les deux herbicides ont présenté une efficacité similaire dans la lutte contre *S. halepense* issu des graines, cependant que Fusilade a été nettement supérieur à Kusagard contre *S. halepense* issu des

rhizomes. Dans les variantes traitées avec Fusilade à des doses au-dessus de 3 litres/ha les plantes de *S. halepense* ont séché complètement et n'ont plus été capables de régénérer, cependant que dans les variantes traitées avec Kusagard, même à la dose de 6 kg/ha, les plantes de *S. halepense* issues des rhizomes n'ont séché que temporairement et ont formé de nouvelles pousses et des épis jusqu'en automne.

Les plus grands rendements du tournesol ont été enregistrés chez les variantes desherbées en post-levée avec Fusilade.

EFICACIA DE LOS HERBICIDAS FUSILADE Y KUSAGARD EN EL COMBATE DEL *SORGHUM HALEPENSE* DE LAS SEMILLAS Y RIZOMAS EN LA CULTURA DEL GIRASOL

Resumen

En los últimos años, *Sorghum halepense* ha llegado a ser una malahierba dominante en el Campo del Danubio y en el Oeste de Banat, disminuyendo la producción de girasol hasta el 50%. Herbicidas como el prometryno y el trifluralino, que se usaban hasta

ahora no resuelvan sino parcialmente el problema con esta mala hierba, sobre todo porque las plantas que provienen de rizomas no están combatidas.

En el período 1980—1981, en el Instituto de Investigaciones para cereales y plantas técnicas de Fundulea fueron organizados las primeras culturas comparativas con los nuevos herbicidas selectivos Fusilade y Kusagard aplicados post emergentemente (tras la brotación) en dosis de 1,5—8 l/ha.

Los dos herbicidas han presentado una muy buena selectividad para el girasol y una eficacia semejante en el combate de las plantas de sorgo provenientes de semillas. Pero Fusilade resultó netamente superior en el combate del sorgo de los rizomas. En las variantes tratadas con Fusilade, con dosis aún de 3 l/ha, las plantas de *S. halepense* se han secado completamente y ya no ha sido capaces de regeneración.

El herbicida Kusagard aún en dosis grandes, de 6 kg/ha no ha resultado satisfactorio: las plantas de sorgo salidas de rizomas se han secado sólo temporalmente y han surgido brotes nuevos que han formado espigas hasta el otoño.