

- [54] **SYNERGISTIC HERBICIDAL COMBINATION**
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[56] **References Cited**

U.S. PATENT DOCUMENTS

- 3,690,865 9/1972 Ahle 71/118
3,707,366 12/1972 Cahoy 71/118

- 3,718,455 2/1973 Baker et al. 71/118
4,001,004 1/1977 Toyama et al. 71/118
4,008,069 8/1977 Ahle 71/118

FOREIGN PATENT DOCUMENTS

- 2453912 5/1975 Fed. Rep. of Germany .
7928450 8/1971 Japan .
7928454 5/1971 Japan .
51-12925 1/1976 Japan .

OTHER PUBLICATIONS

Aggour, Chem. Abst., vol. 96 (1982), 15975c.
Pesticide Manual, 6th Edition (1979), pp. 61 and 378,
British Crop Protection Council.

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[57] **ABSTRACT**

A mixture of the herbicides napropamide and butam has been found to exhibit synergistic results, particularly in pre-emergence surface application or pre-plant incorporation, and for controlling weeds in the presence of a rapeseed crop.

5 Claims, No Drawings

TABLE I-continued

Napropamide	Butam	Rape-seed		Annual rye-grass		Barn-yard-grass		Fox-tail		Lambs-quarter		Pig-weed		Wild Buck-wheat	
		O	E	O	E	O	E	O	E	O	E	O	E	O	E
		—	0.50	0		30		65		20		30		40	
0.25	0.25	0	0	50	20	80	44	30	20	65	28	50	5	10	0
0.25	0.50	0	0	78	30	90	72	60	20	68	44	40	40	30	0
0.50	0.25	0	0	85	56	85	75	78	60	75	73	55	52	50	30

EXAMPLE 2

(Field Tests, Pre-plant Incorporation)

Sprayable solutions containing napropamide and butam were prepared by mixing a wettable powder containing approximately 50 weight % napropamide with an emulsifiable concentrate containing approximately 6 pounds per gallon (0.72 kg per liter) butam, and water. The solution was sprayed on field test plots in various locations in France, West Germany, and Great Britain, at an application rate of 0.75 kg/ha (0.67 lb/acre) napropamide and 1.44 kg/ha (1.28 lb/acre) butam. After spraying, the soil was filled to incorporate the herbicidal mixture, and was then planted with rapeseeds. Other plots at the same locations were similarly treated with napropamide and butam alone, at the same rates before planting, and one plot was left untreated as a check. Tests were conducted during the fall season.

Undesirable vegetation which appeared in the plots

Germany: volunteer barley, *Alopecurus myosuroides*, *Galium aparine*, *Lamium amplexicaule*, *Matricaria chamomilla*, *Stellaria media*, *viola arvensis*
 Great Britain: volunteer barley, *Alopecurus myosuroides*, *Matricaria* spp., *Senecio vulgaris*, *Stellaria media*

Results of these tests are contained in the following Tables II-IV. Control of weeds and phytotoxic effect on crops were determined by visual comparison with the untreated check plots. In all cases, the combination of napropamide and butam resulted in little or no damage to the rapeseed crop.

Synergistic control effects were found in West Germany in volunteer barley and in France of *Sinapis arvensis*. In a number of the tests, the control of a given weed by one of the two compounds was sufficiently high so as to leave no effective possibility of improvement at the application rates. Limpel's Formula was used as above in determining synergistic activity.

TABLE II

Compounds and Application Rates (kg/ha)	FRANCE						
	Control, %						
	Volunteer barley	Volunteer wheat	<i>Alopecurus myosuroides</i>	<i>Matricaria chamomilla</i>	<i>Sinapis arvensis</i>	<i>Veronica persica</i>	<i>Veronica hederifolia</i>
Napropamide, 0.75	100	56	95	87	50	90	96
Butam, 1.44	79	79	97	87	0	85	39
Napropamide, 0.75 + Butam, 1.44	96	79	98	87	76*	86	98

*Expected Control - 50%

TABLE III

Compounds and Application Rates (kg/ha)	WEST GERMANY						
	Control, %						
	Volunteer barley	<i>Alopecurus myosuroides</i>	<i>Galium aparine</i>	<i>Lamium amplexicaule</i>	<i>Matricaria chamomilla</i>	<i>Stellaria media</i>	<i>Viola arvensis</i>
Napropamide, 0.75	40	50	20	43	78	71	10
Butam, 1.44	60	50	60	46	61	77	10
Napropamide, 0.75 + Butam, 1.44	95*	70	40	71	94	93	43**

*Expected control - 76%

**Expected control - 20%

TABLE IV

Compounds and Application Rate (kg/ha)	GREAT BRITAIN				
	Control, %				
	Volunteer barley	<i>Alopecurus myosuroides</i>	<i>Matricaria</i> spp.	<i>Senecio vulgaris</i>	<i>Stellaria media</i>
Napropamide, 0.75	25	74	59	87	54
Butam, 1.44	54	79	14	0	60
Napropamide, 0.75 + Butam, 1.44	66	90	66	86	66

included:

France: volunteer barley, volunteer wheat, *Alopecurus myosuroides*, *Matricaria chamomilla*, *Sinapis arvensis*, *Veronica persica*, *Veronica hederifolia*

65 Compositions containing the two herbicides napropamide and butam may be prepared in a number of conventional ways. Butam is a colorless oil, insoluble in water but very soluble in ethanol, benzene and toluene, and is commercially marketed in the form of an emusifi-

able concentrate. Napropamide is a solid and is commercially marketed in several forms including granular, wettable powder, and flowable (concentrated aqueous suspension). Formulations or compositions for applying the two herbicides in combination may be prepared, for instance, by mixing a wettable powder containing napropamide (50 weight percent) with an emulsifiable concentrate containing butam, in water, to prepare a sprayable solution. The amounts of water, napropamide and butam, are selected so as to provide solutions containing the desired ratio of napropamide to butam and for application at the desired rate.

Alternatively, a herbicide composition containing napropamide and butam can be prepared from the technical grade herbicides, with suitable adjuvants, and then mixed with water to form a sprayable solution. An example of such a composition is:

Component	Weight %
napropamide, technical grade (93% pure)	14.2
butam, technical grade (95% pure)	33.3
1,1,1-trichloroethane	47.6
surfactants	4.9
Total	100.0

What is claimed is:

1. A synergistic herbicidal composition comprising a mixture of herbicidally effective amounts of napropamide and butam, in a weight ratio of between about 2:1 and about [1:2] 1:2.4.
2. A composition according to claim 1 in which the weight ratio of napropamide to butam is about 2:1.
3. A composition according to claim 1 in which the weight ratio of napropamide to butam is about 1:1.
4. A composition according to claim 1 in which the weight ratio of napropamide to butam is about 1:2.
5. A composition according to claim 1 in which the weight ratio of napropamide to butam is between about 2:1 to about 1:2.

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