

Subsurface herbicide layer controls yellow nutsedge

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For most of the past two decades, preplant application of the herbicide Treflan (trifluralin) has been a primary means of controlling weeds over most of California's dry bean acreage. In many cases, the continued reliance on Treflan and chemically related herbicides has led to an increase of weeds tolerant to this herbicide. Nutsedge and members of the nightshade family have thus become severe problems in many bean producing areas of the state. Yellow nutsedge, because of its perennial habit and adaptability to bean culture, has become a particularly prevalent and persistent pest. Recent trials have demonstrated the potential for using other herbicides in layered applications to overcome this problem.

The problem

Previous research with herbicides in dry beans and other crops has indicated that nutsedge can be controlled with a preplant incorporated application of Lasso (alachlor). Unfortunately, commercial applications of Lasso have given erratic results: good nutsedge control has been attained in some fields, poor control in others. The poor results have usually been linked to inadequate soil moisture or to excessive dilution of the herbicide by deep soil incorporation.

In California, beans typically are planted to moisture, with the surface 2 inches of soil remaining relatively dry through the first few weeks of the growing season. Although this practice cuts incidence of bean disease and can control annual weeds germinating in the surface 2 inches of soil, it also means that shallowly incorporated Lasso is placed primarily in dry soil. As a result, the herbicide is less effective in controlling nutsedge emerging from the moist soil below. Deep incorporation (4 to 6 inches), which places part of the herbicide in moist soil, also decreases Lasso's nutsedge effectiveness by decreasing the relative concentration of the herbicide in the soil.

Subsurface layering

Subsurface layering experiments were conducted in beans to circumvent the problems inherent with conventional incorporation. This method employs a spray blade to apply a thin horizontal layer of herbicide at a prescribed soil depth. The spray blade—a

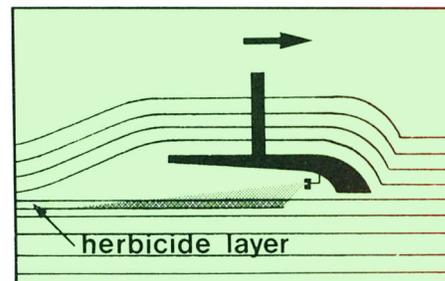
horizontal metal plate, blade, or sweep strategically fitted with spray nozzles—sprays the herbicide solution in a continuous, subsurface swath while being pulled through the soil. An herbicide such as Lasso can be applied at an effective concentration in moist soil without the soil dilution of conventional incorporation. Since Lasso is readily absorbed by plant shoots, the layered application creates an effective barrier to emerging nutsedge.

We used various types of spray blades in our experiments. A flat blade (see diagram) was used to apply herbicide layers in flat-planted fields, and a slanted blade with forward-pointing nozzles was used in prebedded fields. A third type with a perforated manifold instead of spray nozzles has been used successfully in commercial fields in Monterey County.

Results

Excellent nutsedge control was attained in several subsurface layering experiments conducted in 1978 in growers' fields and under more controlled conditions on the Davis campus. Trials blading Lasso at 2 to 4 pounds per acre resulted in 94 to 99 percent control of yellow nutsedge (see table).

This herbicide was fairly short-lived in the soil, and weed control began to dissipate after 4 to 6 weeks. However, this was sufficient time for the beans to become established and to shade-out late emerging nutsedge shoots, thus greatly reducing the weed's early competitive potential. Bean yields were confounded by late-season disease problems and thus could not be related to the weed control treatments.



Herbicide is applied in a continuous subsurface swath as flat spray blade is pulled through the soil.

Generally, beans did not show a phytotoxic response to the layered treatments. Stands were not reduced, and of the varieties tested, only blackeyes were sensitive to Lasso. Kidneys, baby limas, large limas, and small whites all appeared tolerant. In county experiments with cooperating commercial growers, the layer was applied deep enough to ensure herbicide placement in moist soil (usually 3 to 4 inches deep) without regard to planting depth. In these trials and in controlled experiments at Davis, bean tolerance to layered Lasso treatments did not depend on whether the beans were planted above or below the level of the herbicide. However, the tolerance shown by beans planted below the herbicide may have in part been due to the disturbance of the layer by the planter shoe.

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Herbicide	Rate (lb/acre)	Bean stand counts*†	Nutsedge counts*†	Percent nutsedge control†
Kidney beans‡				
Lasso (alachlor)	2	111 a	11 b	94 b
Lasso	4	109 a	5 b	97 b
untreated	—	109 a	183 a	0 a
Large lima beans§				
Lasso	2	63 a	11 b	98 b
Lasso	4	57 a	7 b	99 b
untreated	—	62 a	545 a	0 a

*Bean and nutsedge counts are the average number of plants found in 50 feet of row over four replications.
†Numbers followed by a different letter are statistically different at the 1 percent level of significance.
‡San Joaquin County.
§Stanislaus County.