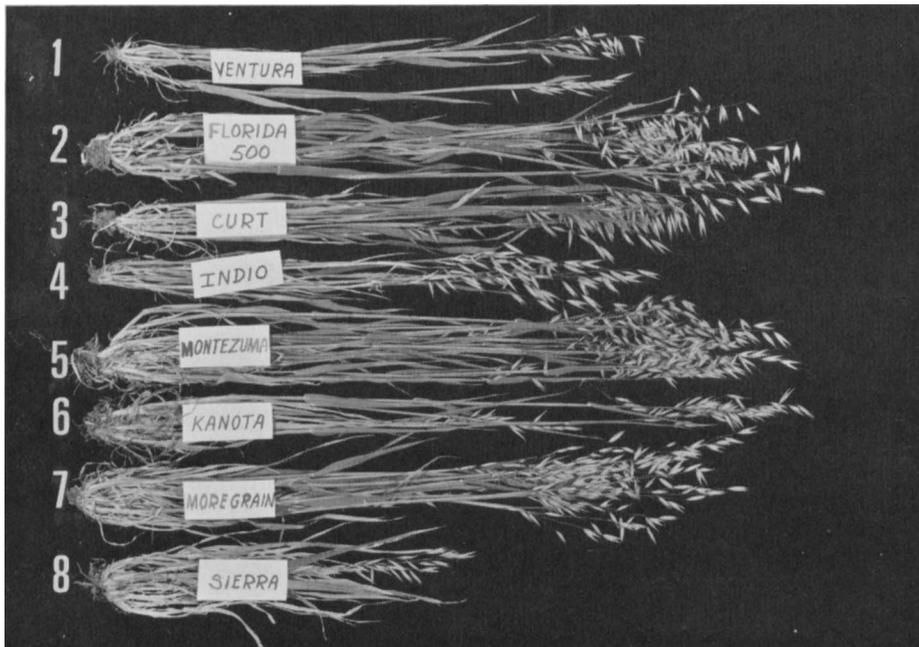


# Oat variety testing for tolerance to nematode-caused "TULIP ROOT"

R. A. BRENDLER • W. H. ISOM • J. D. RADEWALD • F. SHIBUYA



A comparison of the oat varieties at maturity grown in the test evaluating tolerance to *Ditylenchus dipsaci*. 1) Ventura, 2) Florida 500, 3) Curt, 4) Indio, 5) Montezuma, 6) Kanota, 7) Moregrain, 8) Sierra.



**I**N SOME OF THE COOLER, moist areas along the California coast in Ventura and other counties, growers have been raising oats annually on the same land. During years when the environmental conditions are favorable, the disease called "tulip root," incited by the nematode, *Ditylenchus dipsaci* (Kuhn) Filipjev, is very serious. The varieties California Red and Kanota have been the choice of growers for some time. However, yellow dwarf disease seriously affects California Red, and because the Sierra oats are leafier than Kanota, there is much interest in Sierra as an oat hay variety. A field planting of Kanota and Sierra showed Sierra to be more susceptible to tulip root, although both varieties were seriously damaged.

## Importance

Because of the frequent importance of tulip root to Sierra, growers approached the Extension Service for assistance in finding a solution to the problem. A field trial was established in an effort to find a variety of oats that had tolerance to this pest and would yield well in the area. Varieties tolerant to *D. dipsaci* have been reported from other geographic locations. In addition, the varieties selected for testing were further evaluated by subtreating the main varietal plots with preplant fumigation with 1,3-dichloropropene. It was understood that the fumigation practice probably would not be economically feasible. However, the primary purpose was for a better evaluation of the varietal tolerance to *D. dipsaci*.

The site of the trial was in a small coastal valley in Ventura County. The field had been planted to oats each year for several consecutive years and both Kanota and Sierra had been severely infected with *D. dipsaci* the previous year. Plot size was 28 ft by 50 ft and repli-

Eight oat varieties were tested for tolerance to the nematode *ditylenchus dipsaci*, the causal agent of tulip root in coastal areas of southern California. The field in which the varieties were to be tested had been planted to oats for several years. A subtreatment of preplant soil fumigation with 1,3 dichloropropene was used for the purpose of better evaluation of varietal tolerance. Field varieties Curt and Moregrain performed well in yields of grain and straw, and the varieties Kanota and Sierra, commonly grown in the area, were severely injured by *Ditylenchus dipsaci*. The fumigation treatment increased both grain and straw yields of some varieties; however, the increase was not economically significant and cannot be recommended for control of *Ditylenchus dipsaci* for oats. The variety Curt, which was found to be extremely tolerant in this trial, is now recommended where this nematode has been found in the coastal areas of California.

cated seven times. On January 2, 1969 the subplots (14 ft by 50 ft) were fumigated with 25 gpa of 1,3-dichloropropene. The fumigant was shank-injected on 12-inch centers to a depth of 8 inches and cultipacked immediately after fumigation. Soil temperature at the point of injection was 51°F, and soil moisture was near field capacity. The sand, silt and clay content of the soil was 38, 40, and 22% respectively. Rainfall provided the only water during the growing season. Approximately 1100 *D. dipsaci* were recovered per pint of soil from the plot previous to soil fumigation.

The oat varieties were planted on rows 12 inches apart on January 17, 1969. During the third and fourth day after planting, 3 inches of rain fell, causing water runoff across the trial site. Along with subsequent rainfall, this runoff undoubtedly washed many nematodes back into the fumigated test area. It is doubtful that enough fumigant remained in the soil after the first rain to control the nematodes that were reintroduced into the plot site. On May 22, 1969, 12 plants were selected at random from each variety in the fumigated and nonfumigated subplots. The lower inch of the stems from each of the plants was cut into ¼-inch lengths, composited and mixed. A 20-gm sub sample was then processed for *D. dipsaci* using a mist extractor for 48 hours. The oat varieties in the field plots were harvested on June 9, 1969 and straw and grain weights were taken.

#### Plant weights

Total plant weights and grain weights are listed in table 1. Reduced yields can be attributed primarily to loss of stand after emergence and reduced tillering of those plants that survived the early nematode attack. The varieties Sierra, Kanota, Indio and Ventura were the most se-

verely affected by the nematode (see photo), and the difference in yield of grain and straw between these varieties was not significant. The average total yield of these four varieties was approximately 27% that of Moregrain, the best yielding variety. The average total grain yield of these same four varieties was only 24% of the highest yielding variety, Curt.

#### Soil fumigation

Soil fumigation consistently increased yields of the more tolerant varieties of the oats (Montezuma, Florida 500, Moregrain, Curt) in this test (table 1). The more susceptible varieties, Sierra, Kanota, Indio and Ventura, did not consistently benefit from the preplant fumigation. When the yields of all varieties were pooled and analyzed, the fumigation treatment gave a highly significant increase in total plant weight as well as in grain weight (table 2). The yield increases, however, would not be profitable for growers. The fumigation treatment did show that even the best performing varieties such as Curt and Moregrain were injured to some extent by nematodes.

The nematode count made three weeks before harvest (table 3) was not consistently lowered by the preplant fumigation treatment even though the fumigation did result in significantly higher yields. This variability in nematode counts from the various varieties grown on the fumigated and nonfumigated land is probably attributable to the recontamination of the fumigated soil by the heavy rains and flooding shortly after planting. Had nematode counts been made earlier in the growing season, differences undoubtedly would have been evident.

As a result of this work, it is recom-

TABLE 1. YIELD RESULTS FROM THE OAT VARIETAL EVALUATION TRIAL FOR TOLERANCE TO DITYLENCHUS DIPSACI

Oat variety	Grain & Straw*			Confidence level†		
	F	NF	Avg.	5%	1%	
	gms per plot			lb/A		
Sierra	171.5	180.3	175.9	1054	a	A
Kanota	363.5	234.6	299.1	1793	a	A
Indio	414.1	360.8	397.5	2383	a	AB
Ventura	355.8	459.1	407.5	2443	a	AB
Montezuma	821.2	593.1	707.2	4240	b	B
Florida 500	1177.7	947.5	1062.6	6371	cd	C
Curt	1377.8	951.1	1164.5	6982	d	CD
Moregrain	1357.5	1049.3	1203.4	7216	d	CD
	Grain Only					
	F	NF	Avg.			
Sierra	38.8	43.8	41.3	248	a	A
Kanota	92.3	54.8	75.6	453	ab	AB
Ventura	107.5	127.1	117.3	703	abc	AB
Indio	153.6	152.5	153.1	918	bc	ABC
Montezuma	211.8	172.8	192.3	1153	cd	BCD
Florida 500	294.6	240.1	267.4	1603	d	CD
Moregrain	372.6	253.0	312.8	1876	e	DE
Curt	448.5	361.8	405.1	2429	f	EF

\* F = fumigated; NF = not fumigated

† Means not accompanied by the same letter are different at the confidence levels shown above.

mended that growers plant Curt oats for hay in this coastal area of California where *D. dipsaci* can be such a severe problem. It is inadvisable because of their susceptibility to *D. dipsaci*, to raise the California varieties Sierra, Kanota, Ventura, Indio or Montezuma unless a reasonable rotation to non-host crops is practiced. Florida 500 and Moregrain are not recommended at this time even though they grew well in the trial because of their lateness of maturity, the lack of performance data in the area, and the lack of a local seed supply.

*R. A. Brendler is Farm Advisor, Ventura County; W. H. Isom is Extension Agronomist, and J. D. Radewald is Extension Nematologist, Agricultural Extension Service, University of California, Riverside. F. Shibuya is Staff Research Assistant, Agricultural Extension Service, U.C. Riverside.*

TABLE 2. EFFECT OF SOIL FUMIGATION ON ALL OAT VARIETIES (COMBINED) IN THE VARIETAL EVALUATION TRIAL FOR TOLERANCE TO D. DIPSACI

	Grain and straw	Grain only
	lb/A	lb/A
Fumigated	5,110	1,486
Not fumigated	4,091	1,207
LSD 1%	626	129

TABLE 3. AVERAGE NUMBER OF DITYLENCHUS DIPSACI RECOVERED FROM OAT VARIETIES IN VARIETAL EVALUATION TRIAL

Variety	Fumi-gated*	Non-Fumi-gated*	Average Number of D. dipsaci†
Curt	800	384	592
Moregrain	7,200	2,400	4,800
Florida 500	16,800	10,800	13,800
Ventura	10,800	26,400	18,600
Montezuma	63,000	32,400	47,700
Indio	8,400	68,000	38,200
Kanota	75,000	48,000	61,500
Sierra	120,000	51,000	85,500

\* Number of *D. dipsaci* per 20 g of basal tissue.

† The average number of *D. dipsaci* recovered from the oat varieties in the fumigated and nonfumigated plots.