FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

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TALLOWSHIELD

A Means of Improving Vegetable and Vineyard Production

Decreasing water supplies and increasing energy costs to pump irrigation water is focusing greater attention on water-use-efficiency by crops grown in irrigated and supplemental irrigated areas. Over 30% of the world's billions of acres of agricultural lands are fully or partially irrigated. Irrigation is necessary to obtain consistent high yields on all crops and is essential for the existence of a vegetable crop industry. Thus, research on any practice which could enhance water-use-efficiency of rainfall and irrigation water is appropriate.

Drought is one of the most important factors limiting crop production throughout the world. Development of methods to decrease the evaporation of water from plant leaf surfaces (without materially restricting photosynthesis) could drastically reduce the severity of periodic droughts. Antitranspirants have been known for over twenty-five years but little work has been reported on vegetable and field crops.

Antitranspirants have been investigated and their potential to increase yields through more efficient water use has been established. Several commercially available antitranspirants have been used successfully on potatoe crops with consistent yield increases of 4-10 cwt/acre. The yield increases were due to increased tuber size, presumably due to reduction in moisture stress between irrigations. The materials used were emulsifiable waxes and polyethylenes. These data indicate that even though these emulsions can decrease transpiration, care must be taken in the concentrations and formulations used to prevent phototoxicity (leaf burn) from occurring.

In the past, tallow alcohol has been shown to suppress soil water evaporation, but the material was not water soluble. Within the past few years, water soluble tallow emulsions have been developed. Therefore, in 1980, a cooperative research study was initiated between the Texas Agricultural Experiment Station and Fats and Proteins Research Foundation, Inc. to determine if animal tallow, an abundant and renewable resource, could be emulsified and used successfully as a plant antitranspirant.

MATERIALS AND METHODS

The initial studies were concerned with the emulsion formulation stability and phytotoxicity of the emulsion. Following the testing of several formulations, the following formula was found to work quite well as an antitranspirant. The Tallowshield formulation is:

	Percent
Bleachable Fancy Tallow	25.00
Thompson-Hayward T-Det DD-7	6.00
Methyl Paraben	0.25
Propyl Paraben	0.025
BHT	0.025
Citric Acid	0.025
Bacteriastat-Hyamine 1622	0.05
Water	68.625
Total	100.00

Tallowshield emulsion was tested on various crops throughout the evaluation program. It was applied with a modified sprayer at sprayer pressure settings between 200 and 400 psi with a minimum of 125 gallons per acre of mixture. The experimental procedure for potatoes, onions and grapes is as follows:

Potatoes: Tallowshield emulsion at 2%, 3%, 4.5%, 6% and 12% V/V, a standard antitranspirant (Folicote) at 3%, 6% and 9% V/V and a control (water) treatments were evaluated. Sprays were applied with the modified sprayers to the drip point six to eight weeks prior to harvest date.

The experimental design was a split plot with three locations and seven treatments per location. Each treatment plot was 4 rows 20 feet long and replicated 6 times. The center 2 rows of each plot were harvested for data.

Data collected included soil moisture levels, leaf temperature, stomatal diffusive resistance, transpiration rates, tuber yield (both weight and number) and specific gravity of potatoes.

Cultural practices were those employed by the grower which were standard for the area. Irrigation water was applied at approximately 2 day intervals through a center-pivot sprinkler system at a 2 ha-cm per application. Fertilizers were applied both pre-plant and through the irrigation water.

Onions: Tallowshield emulsion at 3%, 6% and 12% V/V, a standard antitranspirant (Folicote) at 2% and 4% V/V and a control (water) treatments were evaluated. Emulsions were applied with a modified sprayer to the point of runoff. All treatments were made prior to noon in an attempt to avoid high afternoon temperatures and were made some four to six weeks prior to harvest.

The experimental design was a randomized block design with data from the center two rows of each plot of four rows by 20 feet being analyzed for each location.

Data collected included leaf temperatures, stomatal defusive resistance, transpiration, soil moisture, bulb grade size and bulb yield by grade.

Normal commercial production practices were applied in the planting and production of these onions. Two applications of insecticides for thrip control and three applications of fungicide for blight control were made in June. Fertilizer applications were 60-154-0 (N-P-K)/ha pre-plant and 43-38-0/ha side dressed.

Grapes: Tallowshield emulsion at 3%, 6%, 9% and 12% V/V a standard antitranspirant (Folicate) at 3%, 6% and 9% V/V and a control (water) treatments were evaluated. The experimental design was a randomized complete block design with each plot being 12 vines and replicated 6 times. Samples were harvested from the two most uniform vines (crop load) in each plot. Pre-harvest samples were 200 randomly selected berries from each plot. Data accumulated included bunches per vine, bunch weight and yield per vine (at harvest), berry weight, juice yield per gram berry weight, Brix pH, total acids and potassium ion concentration on fresh and frozen samples.

Testing of the Tallowshield emulsion has also been evaluated to a very limited extent on such crops as cotton, peanuts and peppers.

RESULTS AND DISCUSSION

Over the years, Tallowshield application at the 6% V/V level resulted in increased carton counts of eight ounce potatoes. This increase in carton count of eight ounce potatoes occurred over a range of soil types, field locations, moisture availability and variety of potatoes in the test. Total yields were found to be equal or increased over the control plots.

Tallowshield emulsion application at the 6 or 9% V/V level did not result in a significant yield increase of onions. However, the Tallowshield treatment did increase the production of onions greater than three (3) inches in diameter.

Tallowshield emulsion treatment at the 6 or 9% V/V level resulted in increased bunch size, improved berry weight, increased juice volume, reduced pH and potassium ion concentration (improved juice quality), as well as delaying maturity in Chenin Blanc grapes. No effects were observed with treatment on Brix or total acid production.

Limited evaluation of Tallowshield emulsion treatment with peanuts indicates that the antitranspirant will significantly increase sound mature kernels and in-shell peanuts per acre.

Tallowshield evaluation as an antitranspirant with other crops has been so limited that it is not possible to assess its value as an antitranspirant with these crops at this time.

SUMMARY

Little has been done on the practical use of antitranspirants to increase the yield of vegetable and vineyard crops. The objective of these studies was to develop a tallow based stable antitranspirant emulsion that would increase the yield response of various vegetable and truck farming crops. Tallowshield at the 6% V/V level increased total production and carton-count of eight (8) ounce potatoes per acre. Tallowshield treatment at the 6 or 9% V/V level increased the production of three (3) inch diameter onions and increased bunch size, berry weight, juice volume, reduced pH and potassium ion concentration as well as delaying maturity in Chenin Blanc grapes. It was concluded that antitranspirant application is a feasible method of increasing vegetable and vineyard yields under moisture-stress conditions evaluated in this study.