

## Tangent™ and Pindar™ GT Herbicides for Weed Control in Tree Crops\*

James P. Mueller, Dow AgroSciences, Brentwood, CA. [jpmueller@dow.com](mailto:jpmueller@dow.com)

Pindar GT Herbicide (oxyfluorfen plus penoxsulam) combines two herbicidal modes of action into one product. Oxyfluorfen is a PPO (protoporphyrinogen oxidase) inhibitor in HRAC mode of action group E. For many years, it has been the standard for residual weed control in tree crops. Penoxsulam is a potent ALS (acetolactate synthase) inhibitor in HRAC group B. It provides extended residual weed control for tree crop orchards at 17.5 to 35 grams active ingredient per hectare (0.016 to 0.032 lb a.i./acre). This combination provides broad spectrum and long lasting pre-emergence and post-emergence control of difficult to control broadleaf weeds and some major grass species. Pindar GT controls weeds which are resistant to other herbicide classes, and is now registered for use in US tree nut orchards.

Tangent is an SC (suspension concentrate) formulation containing penoxsulam at 240 g/L (2 lb/gal). Like Pindar GT, Tangent is effective on a wide range of broadleaf and grass weeds. Tangent registration for tree nuts is expected in 2011. Its fit in tree crop herbicide programs is now being defined. As Tangent research currently is in progress, it will be reported next year.

More than 100 weed control efficacy trials were conducted with Pindar GT from 2004 through 2010 in US tree nuts and in open fields. These replicated experiments involved pre-emergence and early post-emergence application during tree dormancy (December through February). Based on this extensive research under a wide range of conditions, Pindar GT is known to control the most difficult broadleaf weeds infesting tree nuts: hairy fleabane (*Conyza bonariensis*), horseweed (*Conyza canadensis*), filarees (*Erodium* species) and mallows (*Malva* species). Pindar GT also controls at least 60 other weed species, including most broadleaf weeds of importance to tree nut growers. It also controls some of the major grass weeds, such as barnyardgrass (*Echinochloa crus-galli*), bromegrasses (*Bromus* species), large crabgrass (*Digitaria sanguinalis*), wild barley (*Hordeum leporinum*), wild oat (*Avena fatua*), annual bluegrass (*Poa annua*) and witchgrass (*Panicum capillare*).

From 2004 through 2010, a large and thorough research project was conducted to document the safety of Pindar GT to tree nut crops. In addition to the efficacy trials described above, Pindar GT was tested in 37 crop safety trials in all major tree nut production areas. Many of these sites received three years of consecutive applications at up to four times the maximum label rate. Tree growth, tree vigor and crop yield were assessed. Pindar GT was shown to be safe to bearing and non-bearing tree nuts when used according to label directions.

To validate these research results under commercial use conditions, Pindar GT was compared to grower standard programs in 23 large scale demonstration trials in tree nuts. Treatments were applied in the winter 2009 – 2010 dormant period in the San Joaquin and Sacramento Valleys of California. Demonstration trial participants used Pindar GT in one spray tank load and treated the rest of the orchard with flumioxazin (Chateau®) and/or rimsulfuron (Matrix® FNV)

herbicides. Demonstration trial participants chose the spray adjuvant, a contact (“burndown”) herbicide and a grass control product. Data collected were percent control compared to a nearby untreated area within the orchard.

The relatively high rainfall amounts which occurred in 2010 provided a challenge for residual herbicide programs. Pindar GT was shown to deliver consistent weed control across a wide range of weed species, soil types and rainfall levels. In most trials, Pindar GT performed better than the standard residual herbicide program used by the growers. Pindar GT provided four to six months control of the major broadleaf weed species infesting tree nut orchards in California, including glyphosate - tolerant populations of *Conyza* (fleabane, horseweed). No crop safety, tank mixing or tank clean out issues occurred with Pindar GT during this commercial validation project.

Based on over 100 replicated research trials and 23 large scale demonstration trials, Pindar GT performance is consistent across soil types, geography and weather conditions. The high rate provides four to six months of residual weed control. The broad weed control spectrum and pre- and post-emergence activity of Pindar GT was illustrated in these research projects. The two modes of herbicidal action in Pindar GT will be valuable for weed resistance management. An extensive crop safety research program illustrated that Pindar GT has excellent crop safety when used according to label directions.



\* The author would like to thank the many cooperators and co-workers who contributed to this project, especially Barat Bisabri, Marc Fisher, Rick Mann, Jesse Richardson Debbie Shatley, Monica Sorribas and Jagadeesh Yerneni.

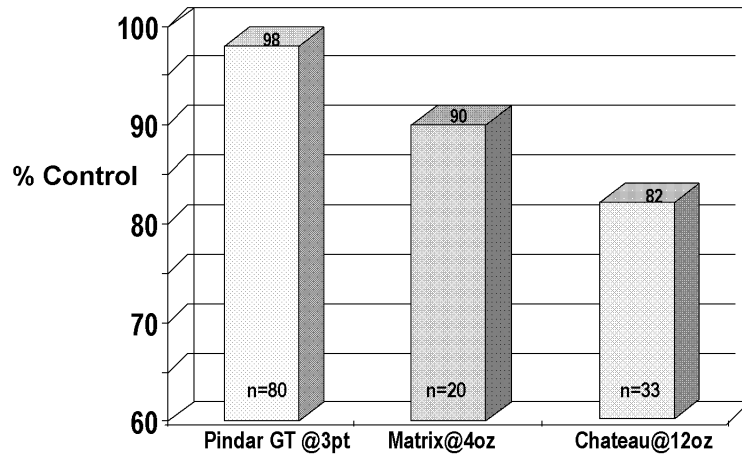
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## Summary across trials: fleabane (*Conyza bonariensis*)

### *Fleabane control 6 months after application\**

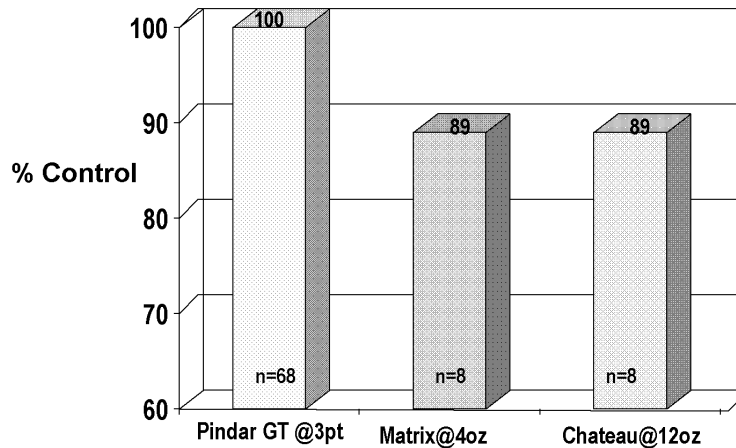


\* n=number of observations

All treatments included glyphosate at 1.5 lb a.e./acre.

## Summary across trials: horseweed (*Conyza canadensis*) including glyphosate-tolerant populations

### *Horseweed control 6 months after application\**

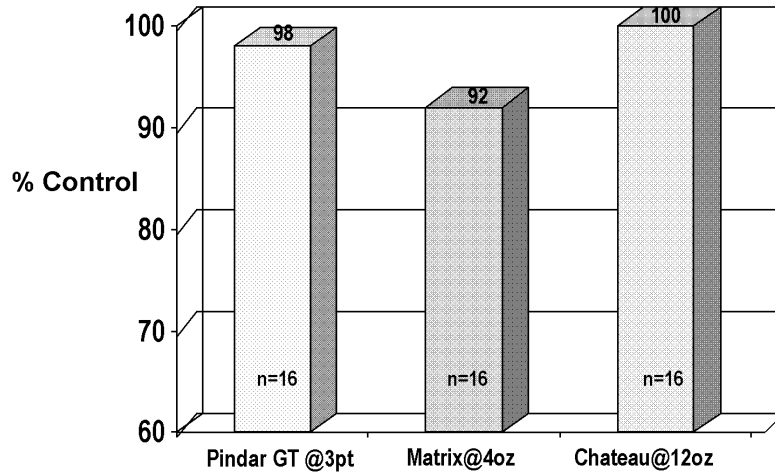


\* n=number of observations

All treatments included glyphosate at 1.5 lb a.e./acre.

## Summary across trials: filarees (*Erodium* species)

### *Filaree control 6 months after application\**

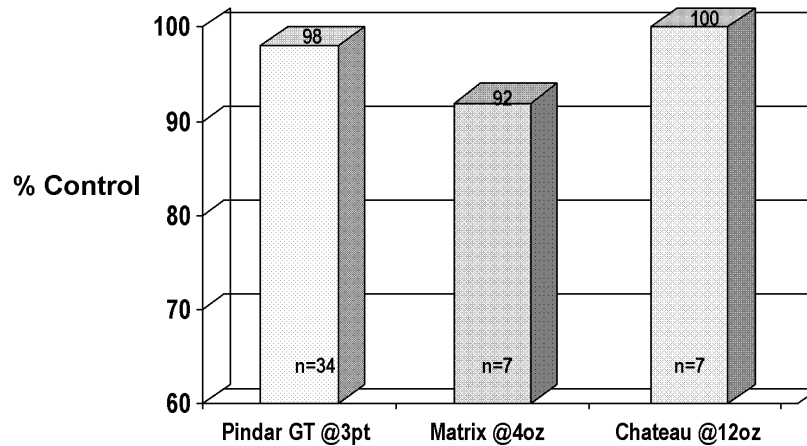


\* n=number of observations

All treatments included glyphosate at 1.5 lb a.e./acre.

## Summary across trials: *Malva* species

### *Malva control 6 months after application\**

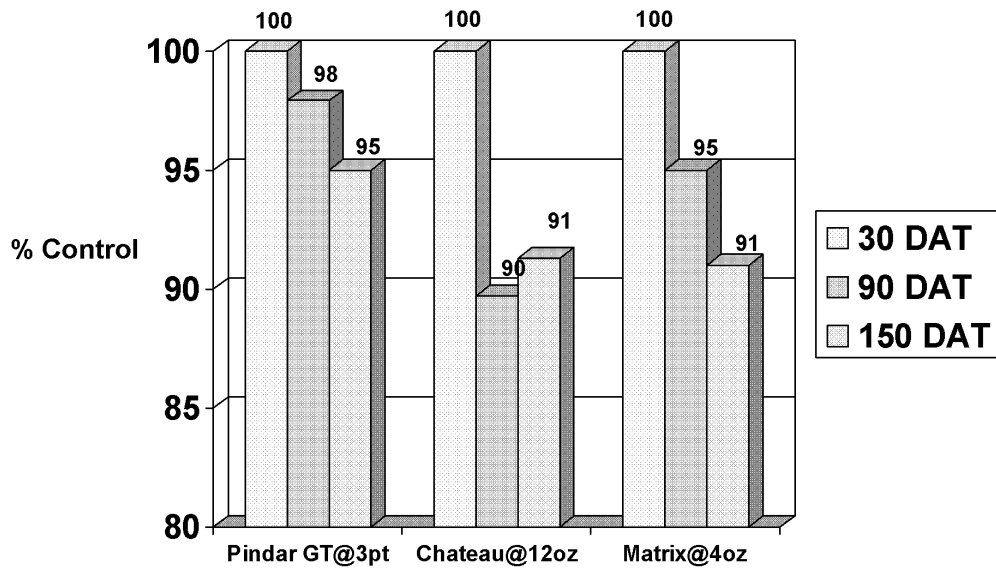


\* n=number of observations

All treatments included glyphosate at 1.5 lb a.e./acre.

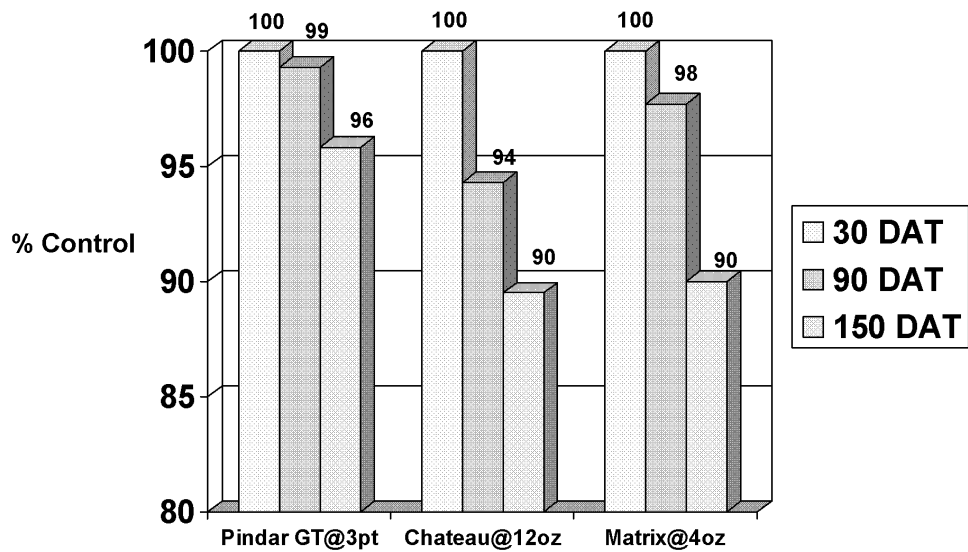
## Pindar GT demonstration trials in tree nuts 2009-2010

### *Fleabane* control 30, 90 and 150 days after application



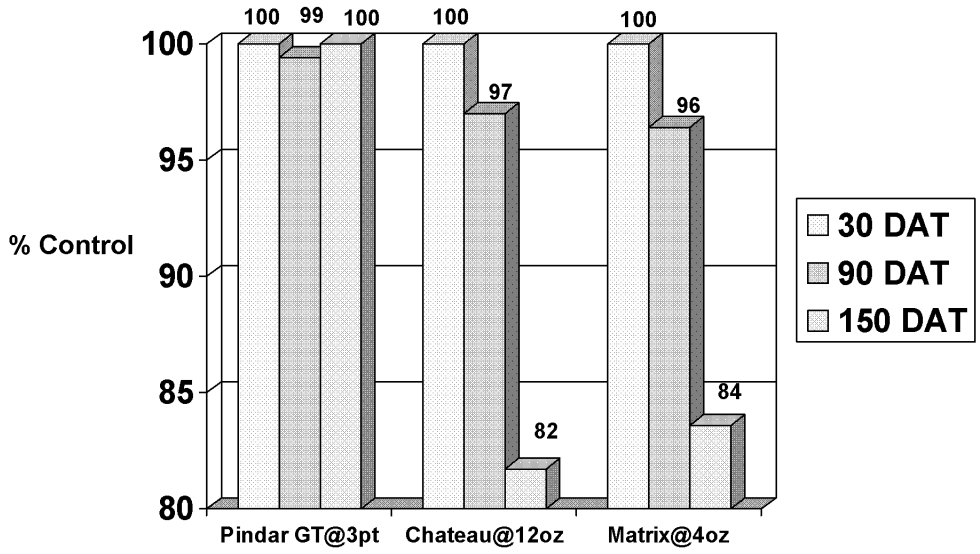
## Pindar GT demonstration trials in tree nuts 2009-2010

### *Horseweed* control 30, 90 and 150 days after application



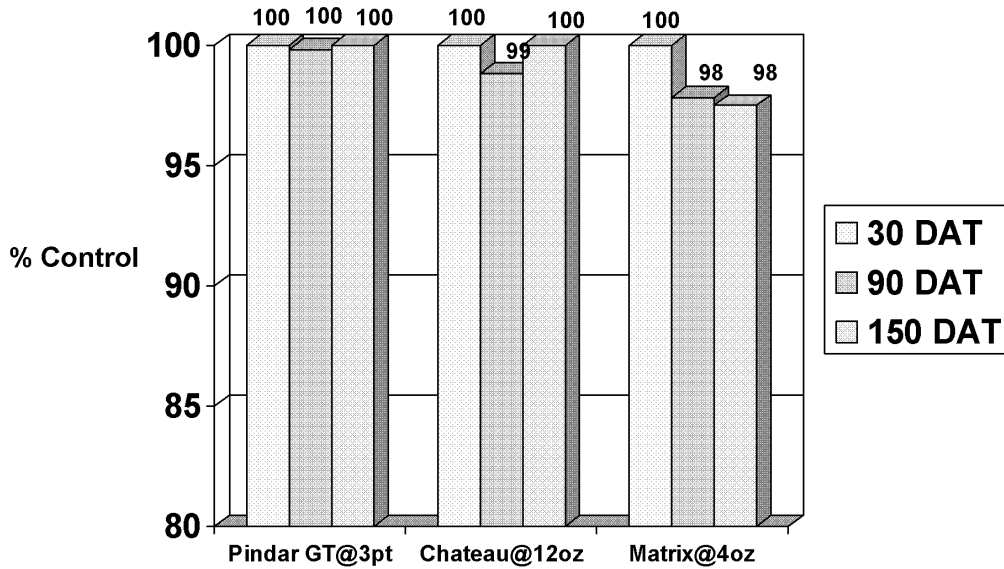
**Pindar GT demonstration trials in tree nuts 2009-2010**

*Filaree* control 30, 90 and 150 days after application



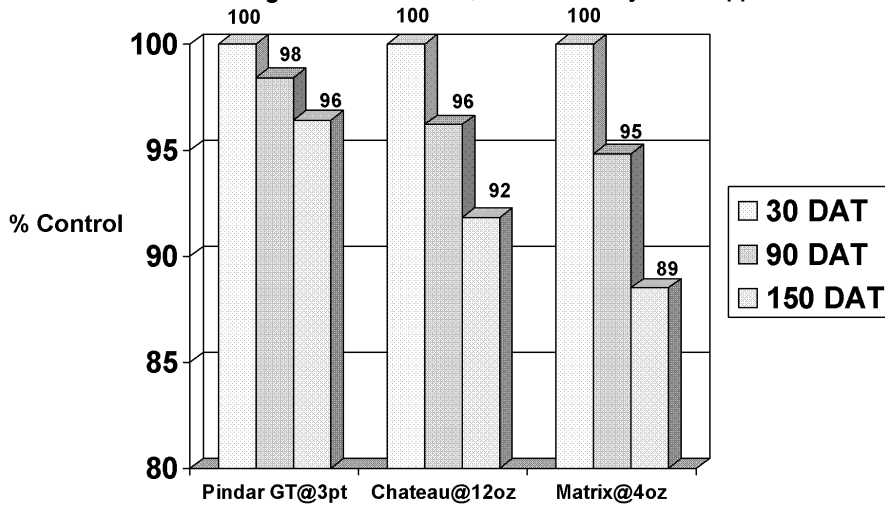
**Pindar GT demonstration trials in tree nuts 2009-2010**

*Malva* control 30, 90 and 150 days after application



**Pindar GT demonstration trials in tree nuts 2009-2010**

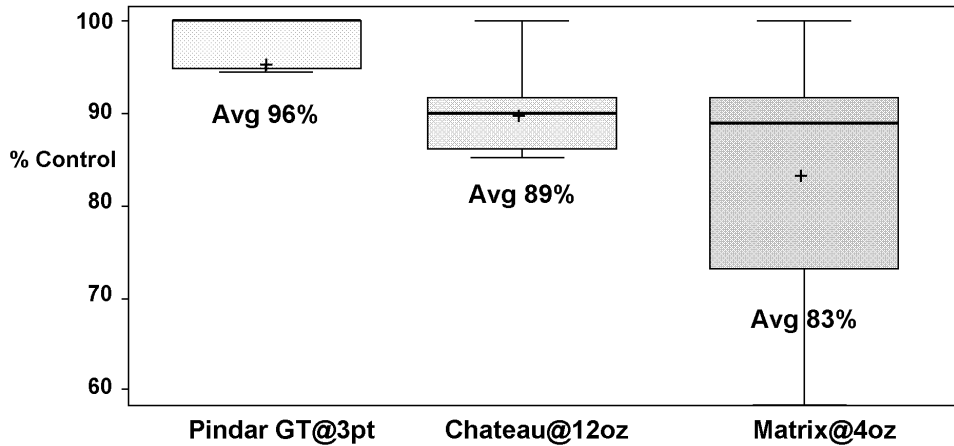
**All broadleaf and grass control** 30, 90 and 150 days after application



*[A grass herbicide tank-mix partner was not included.]*

**Pindar GT demonstration trials in tree nuts 2009-2010**

This box plot illustrates **consistency of broadleaf weed control** 150 days after application, summarized across 23 locations



*[A grass herbicide tank-mix partner was not included.]*