

ECONOMICS OF CONTACT VERSUS RESIDUAL WEED CONTROL IN WALNUTS AND PISTACHIOS

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Weed pressure and competition for water and nutrients significantly impact pistachio and walnut growth during the first 5 to 7 years after planting. In walnuts, for example, if weeds are allowed to grow next to the trees, they will not attain the necessary 8 feet of growth the first year to be able to head them at 6 to 6.5 feet tall. Consequently, the grower will have to cut them back to 2 buds and start over, or compromise their heading height and wind up with the primary branches too low to avoid damage from tractors and harvesters. In pistachios, drip and fanjet emitters are placed close to the base of pistachio trees, making gopher damage a problem, especially when yellow nutsedge is present. If not controlled during orchard establishment, growers will find that the cost of herbicides is far cheaper compared to the loss of trees from gopher damage. In walnuts, growers furrow irrigate the first 2 years after planting, which promotes rapid weed growth in the furrows and potential for waterlogged walnut roots, leading to tree decline or death.

Weeds are also known to host economic insect pests in tree nuts. Knotweed, spotted spurge, and London rocket host false chinch bug, which can kill young trees in late April or early May when the weeds dry down. Russian thistle, clovers, and birdsfoot trefoil are hosts for lygus and stink bugs. These insects attack nuts in the soft and hard shell stages, causing epicarp lesions and kernel necrosis.

Herbicides play a necessary role in walnut and pistachio production. If herbicides are not used following planting, growers resort to cross-disking to destroy the vegetation. This can lead to tree damage by debarking or cutting off tree roots, a cause of crown gall infection. Tree canopy development and shading is slower to develop in pistachio than walnut orchards, increasing the need for herbicide use for a longer period of time in pistachios.

While several herbicides are available in pistachios and walnuts (table 1), soil residual herbicides are essential for the first 5 to 7 years after planting to reduce the negative impacts associated with weed growth. Soil residual herbicide selection in pistachios is limited, but if properly used, can significantly reduce problems associated with allowing weeds to grow before treating with contact herbicides. Although contact herbicides are generally less expensive than soil residual herbicides (table 2), there are significant problems that can arise if they are relied upon solely, particularly in the first years following planting. Selecting an herbicide program based solely on cost or economics to save a few bucks early on less expensive postemergence sprays should not be the reason for herbicide choice, since it will cost at least \$7,000 an acre to establish the trees for the first 6 years.

Contact programs begin to have greater potential in mature orchards where: (1) several years of soil residual treatments will limit the weed population and reduce the likelihood of new weed seed introduction, (2) the weed spectrum will be narrowed, (3) the additional postemergence spot treatments during the season required to substitute for not applying soil residuals do not exceed the cost of the preemergents, and (4) lighter equipment, such as ATV sprayers, can be used instead of more expensive boom sprayers used for soil herbicide applications.

Table 1. Herbicides registered in pistachios and walnuts in California in 2004

Soil residual herbicides	Pistachio	Walnut
Dichlobenil (Casoron)	Not registered	Bearing and non-bearing
Diuron (Karmex, Direx)	Not registered	Established at least 1 year
EPTC (Eptam)	Not registered	Bearing and non-bearing
Napropamide (Devrinol)	Bearing and non-bearing	Bearing and non-bearing
Norflurazon (Solicam)	Not registered	Established at least 1.5 years
Oryzalin (Surflan)	Bearing and non-bearing	Bearing and non-bearing
Oxyfluorfen (Goal)	Bearing and non-bearing	Bearing and non-bearing
Simazine (Princep)	Not registered	Established at least 1 year
Trifluralin (Treflan)	Not registered	Bearing and non-bearing
Isoxaben (Gallery T&V)	Non-bearing only	Non-bearing only
Pendimethalin (Prowl)	Non-bearing only	Non-bearing only
Thiazopyr (Visor)	Non-bearing only	Non-bearing only
Contact herbicides		
Glufosinate (Rely)	Not registered	Bearing and non-bearing
Glyphosate (Roundup)	Bearing and non-bearing	Bearing and non-bearing
Paraquat (Gramoxone)	Bearing and non-bearing	Bearing and non-bearing
Sethoxydim (Poast)	Non-bearing only	Bearing and non-bearing
Sulfosate (Touchdown)	Non-bearing only	Bearing and non-bearing
2,4-D (Weedaxe, etc.)	Established at least 1 year	Established at least 1 year
Clethodim (Prism)	Non-bearing only	Non-bearing only
Diquat (Reglone)	Non-bearing only	Non-bearing only
Fluazifop (Fusilade)	Non-bearing only	Non-bearing only
MSMA	Not registered	Non-bearing only

Several problems are associated with relying primarily on less expensive contact herbicides for weed control during orchard establishment:

1. Weeds that are already established are obviously competing for essential water and nutrients, taking away from early tree growth and development. Since the trees are planted during the dormant period, it may be difficult for the grower to be able to enter the field under rainy and wet conditions in a timely manner before these weeds get too large for control or produce seed. In the spring and summer, nutsedge becomes quite competitive, which can become a real problem if growers allow it to develop beyond the 4th or 5th leaf stage so that new tubers are formed and perpetuate the problem, even if burned down with foliar herbicides

like paraquat or glyphosate. If hairy fleabane and marehail are present, a more expensive contact herbicide like glufosinate, should be used. It is expensive (about \$20/acre), but has excellent activity on these and other weeds that glyphosate and paraquat miss.

2. Young trees are sensitive to injury from postemergence herbicides like glyphosate and paraquat; very common from accidental contact or drift, especially when weeds are tall at the time of treatment. While these herbicides may not kill the trees, growth is severely hindered. In the case of pistachios, paraquat damage can stop the rootstock from growing, harden off the bark, and make it difficult to successfully bud in July or August. Additionally, pistachios are very sensitive to leaf loss as a result of low lying foliage from unbudded rootstocks.

3. Many times growers select to plant their orchards in fields formerly planted to annual crops like cotton or corn, where the weed spectrum can be extensive. Without using combinations of soil residual herbicides, it is often difficult to get adequate control with postemergence sprays if the weed spectrum is diverse. This usually requires additional trips through the field with contact sprays to keep the population under control.

Table 2. Cost comparison of some typical soil residual and contact herbicides in 2004

Soil residual	Lb a.i./A	Product/A	Product cost (\$)	Cost/Acre (\$)*
Goal 2XL	1.0	2.0 qt	90/gal	14.21
Surflan AS	4.0	4.0 qt	70/gal	22.11
Princep Caliber 90	2.0	2.2 lb	3.60/lb	2.50
Karmex DF	2.4	3.0 lb	3.55/lb	3.36
Prowl 3.3	1.2	3.0 pt	30/gal	3.60
Contact herbicides				
Roundup UltraMax	1.0	1.6 pt	45/gal	3.00
Glyphosate (generic)	1.0	1.6 pt	25/gal	1.58
Rely	1.0	1.0 gal	65/gal	20.53
Gramoxone Max	0.5	1.6 pt	38/gal	2.53
Touchdown	1.0	2.6 pt	42/gal	2.80

*Assumes treating pistachios on a 6' band on a row spacing of 19' and does not include cost of application

For many growers, the question is whether or not soil residual herbicides pay now that contact herbicides, generic glyphosate in particular, can be purchased for about \$25 per gallon. At a cost of \$1.58/acre (based on a strip spray of 6' on 19' row spacing), it is understandable why growers find this appealing. In contrast, a tank-mix of oryzalin plus oxyfluorfen as a soil residual program may cost more than \$36/acre.

Using soil residual herbicides during the first 6 or 7 years of orchard establishment will help avoid many of the major problems associated with relying on contact sprays as mentioned previously. Rather than allowing grassy weeds to become established at planting then spraying with a contact herbicide, a tank-mix application of pendimethalin plus oxyfluorfen in the winter will provide excellent broad-spectrum weed control down the tree row, reducing competition from established weeds. A timely contact spray can then be used to pick up any weeds escaping treatment. A typical preemergence program like this in non-bearing orchards will cost about \$20/acre, but provide several months of residual control. Continuing this program for several years can significantly reduce the weed population, making control with contacts much easier and valuable. If nutsedge is known to be present, it would be beneficial to use an herbicide like thiazopyr during the non-bearing years to reduce or eliminate the population. This reduces the likelihood of promoting additional nutlet production due to delayed postemergence sprays.

There are more soil residual herbicides available in walnuts than in pistachios. A fall or winter strip-spray application of diuron at 3 lbs/acre plus simazine at 2 lbs/acre in a walnut orchard established at least 1 year will eliminate most weeds that may be present at an affordable cost of about \$6/acre (not including spray equipment). Add an additional cost of \$3/acre for a contact spray, like glyphosate or paraquat for small weeds that may be present and it's not hard to see why this program should be very attractive where costs are a concern.

Applying soil residual herbicides for 4 to 5 consecutive years following planting will provide a better opportunity to be flexible in future herbicide choices and use patterns. For example, if an extensive rainy period is anticipated in the fall and early winter months (results in rapid herbicide degradation), consider delaying treatment with oryzalin and oxyfluorfen until late-January or early-February to lengthen residual activity during the summer. An application of oxyfluorfen plus glyphosate applied in the fall, when weeds are small, will often keep the tree rows clean until the residual herbicides can be applied.

Whether or not a grower decides to eliminate their soil residual herbicide program in favor of a contact one is dependent upon several variables that must be considered. Although appealing, one should not base their weed control decisions solely on the ability to purchase contact herbicides cheaply. Pistachio and walnut orchards are a long-term and expensive investment. Although soil residual herbicides are generally more expensive than contact ones, properly selecting and using soil residual herbicides early during orchard establishment will help reduce the likelihood of weed-related problems experienced in contact-only programs.