WALNUT MARKETING BOARD
Research Proposal Cover Page

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Project Title:	Methyl Bromide Alternatives
Contract Period:	2009-2010
Budget Amount:	$24,000
Principal Investigator:	Michael McKenry
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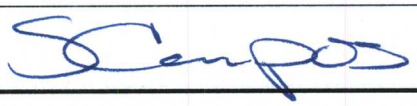
Signature of Authorized Institution Rep:	

AES/CE MAR 84 Workgroup/Department:

University of California
Division of Agricultural Sciences

PROJECT PLAN/RESEARCH GRANT PROPOSAL

Project Year 2009 Anticipated Duration of Project: 2 years

Project Leader: Michael McKenry Location: UC Riverside Nematology

Cooperating Personnel:

ProjectTitle: Methyl Bromide Alternatives

Keywords: *P. vulnus*, *Meloidogyne* spp.

Commodity(s) walnut Relevant AES/CE Project No. 3188H

Problem and its Significance:

The primary goal of our many years of study with walnut has been the development of alternatives to methyl bromide. Given the regulatory constraints associated with Telone treatment of medium and fine-textured soils, the inadequate performance of metam sodium and Basamid in walnut soils and the likelihood of never having iodomethane; our second goal is to replace soil fumigants. The easiest answer is to not grow walnuts for five years; just switch to a non-woody crop like alfalfa. However the economic repercussions to growers who just switch away from their favored perennial crop will be substantial in a global economy. My research direction has been to better understand the replant problem, to identify rootstocks with broader soil pest resistance/tolerance and to identify tactics that destroy the old soil ecosystem. This approach should yield opportunities for growers to replant after one full year of waiting.

For the grape industry we have identified two rootstocks that are tolerant to the rejection component of the replant problem. One of those stocks (O39-16) has resistance to only a single nematode species and the other (10-17A) has resistance to at least six nematode species. Five years after replanting the yield off these two rootstocks is the same whether fumigated or not however, yields from seven other rootstocks was cut in half by lack of fumigation (McKenry, 2006 San Joaquin Valley Table Grape Seminar).

For the stone fruit and almond industries, primarily on Nemaguard rootstock, we have identified one rootstock (Hansen 536) that consistently tolerates the rejection component of the replant problem (www.uckac.edu/nematode) and we are searching for others. Hansen 536 has no Nemaguard parentage and carries nematode resistance similar to Nemaguard except that it is highly susceptible to ring nematode.

Grape, almond and walnut growers need at least two rootstocks each so they can alternate from one to the other in order to avoid the rejection component of the replant problem. These rootstocks need to be of different parentage. Each rootstock should have a soil pest and disease profile complimentary to the other. To reduce the land idling time down to one year for each of these industries we already have a tactic for quickly killing remnant roots, the food source of the prevailing soil ecosystem. Garlon applications will serve this purpose for the walnut industry but lately we have reasons to believe that new approaches using Roundup may accomplish this as well.

The California walnut industry is hugely impacted by *Pratylenchus vulnus*, the root lesion nematode. This nematode is severely damaging particularly to young developing root systems but more specifically

to the newest 3 to 12 inches of each new root initial of the root system. Root-knot nematodes, *Meloidogyne* spp., can be just as damaging to the same root target, but primarily in sandier soils south of Sacramento. There is also the rejection component of the replant problem, an absolute deterrent of root growth for the first full year but they can grow past this malady. With all this root restriction, it is *Phytophthora* root rot that usually finishes off the trees.

For almond and grape growers we have been testing a five-step program to protect against the rejection component. 1) diagnose the problem, 2) kill the remnant root system and idle the land 1 year 3) soil preparation as needed 4) use an alternate rootstock and 5) apply starter nutrients at time of planting. We now refer to this fumigation alternative as 'Starve and Switch'. Unlike almond and grape commodities about 85% of walnut orchards across California are infested with *P. vulnus*. Also availability of diverse rootstock sources for walnut is limited and there are no walnut rootstocks having true resistance to this nematode. We have the paradox VX211 clone with useful hybrid vigor and a modicum of resistance that does translate to some field tolerance. But, we still need to get these trees started out right and our remedy is the finding of rootstocks with parentage different from conventional rootstocks.

We need a broader source of walnut parentage to search for *P. vulnus* resistance. This source will likely be one that permits *P. vulnus* feeding and reproduction at the terminal several inches but not further back. We also need to determine if different walnut sources respond differently with or without fumigation in a replant site. Until nematode resistance is found walnut growers need broadcast fumigation. The rejection component can be solved with spot or strip fumigation. A rootstock with nematode resistance plus different walnut parentage is needed before there is field evaluation of our 'Starve and Switch' approach for walnuts (planting without fumigation). This new/updated project proposal reflects our intention to focus even greater effort toward rootstock screening.

Objectives:

1) Maintain the Rio Oso trial for yield data, rates of nematode return and tree growth
2) Maintain the VX211 and AX1 trial at Kearney Ag Center grafted over to Chandler for yield data.
3) Obtain for further nematode and field evaluations of clones of RX032
4) Continue nematode evaluations of various *Juglans* species from the USDA Davis Repository.
5) Compare all *Juglans* selections in adjacent replicated fumigated and non-fumigated sites in two walnut replant orchards, one following NCB the other Paradox.
6) In 2009 initiate tests of 400 seedlings from the Afghanistan selection of English that served as a parent to Serr. The interest is in a seedling that is resistant to root lesion and root knot.

Plans and Procedures:

Objective 1. The Rio Oso site is now 7th leaf and involves approximately 8 acres with every other tree being either NX or DN paradox. These rows have been planted over soil that received either methyl bromide to the 6 foot depth, Telone II at 50 gallons per acre stripped with delivery to the 4.5 foot depth or a broadcast application of Metam sodium delivered to the 4 foot depth. We need yield data.

Objective 2. Within 48 macroplots ($1/100^{th}$ acre each) at KAC we are maintaining 4 reps of VX211 and AX1 grafted to Chandler for yield collection. Nematode sampling of the soil and trunk measurements will continue twice yearly.

Objective 3. Selection RX032 is a *Juglans microcarpa* that we selected because it performed well against nematodes in our earliest nematode screens. This parentage is different from conventional walnut rootstocks, it appears to be a poor host for root lesion but Wes Hackett has had difficulty

providing us with clones from the tree. Even younger wood will be submitted to Wes Hackett again this year in the hope of obtaining RX032 clones. RX032 is of interest for its host status against nematodes but also for its growth habit against the rejection component.

Objective 4. In winter 2005-06 we received small amounts of Juglans seed from Ed Stover of the Germplasm Repository. These were planted into nematode inoculated soil at KAC. After two years of nematode evaluation seedling #21 of *J. cathayensis* was selected for its absolute resistance to *P. vulnus* and M. incognita. In addition we have sprouted 40 more seeds from the germplasm repository which will be exposed to nematodes in 2009. We will also receive in fall 2008, with the help of Gale McGranahan, numerous Chinese selections of *J. cathayensis* from 20 separate trees. These seedlings will be planted out by spring 2009.

Objective 5. Any trees worthy of future evaluation plus all the trees received from the repository will be sized for uniformity and then planted into adjacent fumigated and non-fumigated sites within a walnut replant site for two years to determine size differences. We usually require 6 trees for each rep and reps are needed because the intensity of the rejection component varies across a field. It will be difficult to find the rejection component without the presence of *P. vulnus*. In fall 2008 we identified a field site that involved 198 25-year-old Black walnut rootstocks. Half the trees in that block have now been treated with Garlon and in 2010 it will be planted with trees of black walnut, *J. cathayensis* #21 and other stocks of interest with and without fumigation. Objectives 4 and 5 will become a major focus of our screening efforts.

Objective 6. From 8 catkin-less Afghanistan trees that produced 900 seeds in 2007 we have collected 400 seedlings that will now be screened for root knot and root lesion resistance. These trees were grown within our mother block of favorite trees, anyone of which could have propagated with the J. regia from Afghanistan. Our standard 2-year screening methods will be employed.

Treatments for each of these objectives will be replicated at least 4 times but our limitation will likely be the availability of adequate walnut selections. All nematode counts will be log-transformed and subjected to ANOVA.

BUDGET REQUEST **2009-10** Budget Year

Funding Source: Walnut Marketing Board

Salaries and Benefits			
Postdocs/RA's			
SRA's	$16,000		$16,000
Lab/Field Assistance			
Subtotal		Sub 2	$16,000
Employee benefits		Sub 6	$ 5,120
		TOTAL	$21,120
Supplies and Expenses		Sub 3	$ 500
Equipment		Sub 4	
Travel		Sub 5	$ 2,380
		TOTAL	$24,000

Department account number _____

_____ Date [signature] 11/22/08

Originator's Signature

COOPERATIVE EXTENSION

County Director _____ Date _____

Program Director _____ Date _____

AGRICULTURAL EXPERIMENT STATION

Department Chair [signature] Date 11/24/08

LIAISON OFFICER _____ Date _____

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