

Project: Weed Science Programs
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Background:

Sustainability of New Mexico's agricultural industries, particularly our vegetable and cotton industries in southern New Mexico, relies on a number of factors including efficient management of our water resources, availability of labor, and management of viruses and soilborne diseases and parasites. Weeds impact crop production as an individual pest as well as by influencing the factors described by the industry as critical threats.

Weeds alone cause over 40% of total pest losses (including insects, diseases, and other pests) in crop production while herbicides account for 65 to 70% of pesticide use in the United States. Yield losses due to weeds in NM production have been documented for chile pepper, cotton, grain sorghum, and other crops. Herbicides that persist in soil and provide season-long weed control are not typically used in NM because of label restrictions. Persistence of a number of herbicides (examples are some of the triazine and sulfonyl urea herbicides) is increased in soils with alkaline pH; soils in NM are characteristically alkaline with pH values between 7.5 and 8.5. Rotational crop restrictions, because of this pH requirement, and because of crop sensitivity to these herbicides, reduce crop choices if these herbicides are used. In addition, due to their minor crop status, few herbicides are registered for use in many of the vegetable crops grown in NM. As a result, one of the primary uses of labor in NM production systems is to remove weeds that cannot be controlled by cultivation or the available herbicides. If labor is not available, weeds go unmanaged and yield losses result.

Several weed management issues face growers. Industry-wide, emphasis on herbicide development has declined since the introduction of glyphosate resistant (Roundup Ready™) crops in the late 1990's. In addition, selection of herbicide resistant biotypes of weeds has increased; of particular concern is increased weed resistance to glyphosate in NM due to the fact that it is the predominant herbicide used in many cropping systems, urban landscapes, riparian areas, and undisturbed ecosystems. Glyphosate resistant Palmer amaranth (*Amaranthus palmeri*) has been documented in NM pecan orchards. Glyphosate resistant Palmer amaranth has caused major economic and management problems for cotton producers in the southeastern U.S. since 2004. Glyphosate is used nearly exclusively for weed management in NM on irrigation canals, in pecan orchards, in urban landscapes, and in Roundup Ready™ cotton. In addition, due to issues with labor availability, development of mechanical thinners and harvesters, and lack of ability to control broadleaf weeds, chile processors and producers are expressing their desire that NMSU scientists engineer a glyphosate resistant chile pepper. Prior to this time, the issue of weed resistance to herbicides has been minor in NM because of the limited use of herbicides that select for resistance; however, with the changes noted above, problems with weed resistance especially to glyphosate will increase.

In addition to the problems caused by weeds as individual pests, weeds serve as alternate, often asymptomatic, hosts of other pests including viruses, soilborne pathogens and parasitic nematodes. The basis for the continuing problem caused by weeds in our production systems is that, once established, the seed and propagule bank in the soil maintains the weed populations in crop fields from one year to the next. Thus weeds are a constant presence and pose a constant management issue in our production systems. An additional factor that makes NM a unique study environment is that, unlike major vegetable producing area in the U.S., NM producers do

not use methyl bromide for suppression of all soilborne pests (weeds, diseases, nematodes, insects) prior to planting high cash value crops. Research into the sustainability of these production systems is highly relevant, not only for NM producers, but also for other regions that will experience the pest complexes and interactions already observed in NM as the use of methyl bromide decreases.

Current research:

We have been conducting field and greenhouse research since 1988. Research has included field evaluations of candidate herbicides for use in chile pepper, onion, cotton, grain sorghum, corn, and pecans; determination of the economic benefit of herbicides and cultivation for weed management in chile pepper; effect of weeds on yield and quality of chile pepper; and growth characteristics of some of the problem weeds found in southern New Mexico production systems. The research has defined the problems that weeds pose in production agriculture in New Mexico and has provided information concerning the effectiveness of herbicides in our soils and under our environmental conditions. Annual reports from 1988 through 2009 have been scanned and posted on the EPWS website, <http://eppws.nmsu.edu/research-programs.html>.

This research program has sponsored undergraduate and graduate student research projects each year. Many of the students conducting research projects in this program have had the opportunity to present the results of their work at a professional meeting. In addition, we maintain a weed garden for use by students taking the weed science classes at NMSU, other programs in the college, and the public. Improvements to the weed garden were made in 2004 with funding from the Rio Grande Basin Initiative.

Current projects include collaborative efforts with other scientists in the Entomology, Plant Pathology, and Weed Science, Plant and Environmental Sciences, and Extension Plant Sciences Departments. The current work can be separated into three broad areas: the interaction between weeds and other pests that are problematic in chile pepper and other crops, projects under the Rio Grande Basin Initiative, and weed biology and management.

Research continues in cooperation with Dr. Stephen Thomas and Jacki Trojan (EPWS nematology) to determine the effectiveness of annual crop rotations compared to alfalfa for suppressing the yellow nutsedge/purple nutsedge/southern root-knot nematode pest complex. Previous research has described a complex, beneficial relationship between these two creeping perennial nutsedge species and root-knot nematode; all these pests are a problem for southern NM cropping systems. In addition, past cooperative research has shown that a 3-year rotation of non-dormant, root-knot resistant alfalfa will suppress the pest complex long enough to produce a subsequent chile crop without the use of pesticides. However, the pest complex returns by the end of the season indicating that other practices are needed to provide sustained management. Research is also in progress to determine the effect of southern root-knot nematode on growth and fecundity of several annual broadleaf weeds that serve as alternate hosts of this nematode; this project is designed to provide new information on additional weed/nematode complexes and clues for sustainable management of these pests. Other collaborative research has included Dr. Soum Sanogo (EPWS, plant pathology) to determine interactions among annual weeds, nematodes, and *Verticillium*. Collaborative work with Drs. Rebecca Creamer and Scott Bundy (EPWS) has researched the biological interactions among the beet curly top virus, beet leafhopper, and London rocket.

Scouringrush or horsetail (*Equisetum hyemale*) is one of the dominant species of weeds found on the irrigation canals of Elephant Butte Irrigation District in Southern New Mexico and,

once established, it can cause significant water loss via ponding and evapotranspiration. Research in cooperation with Dr. April Ulery (PES, soil chemistry) and Jamshid Ashigh (EPS, weed science) is being conducted by James Hill (M.S. candidate) to determine whether the life cycle and rate of spread of *E. hyemale* is affected by canal ecosystem characteristics such as soil properties, vegetation communities, environmental conditions and disturbance patterns, and to evaluate potential management strategies (herbicides and competitive plants) for the weed.

We also are conducting research to determine the timing and pattern of emergence of common weeds in southern New Mexico. This information will provide us and growers with additional tools for researching and planning weed management programs. We continue to conduct research to evaluate candidate herbicides for use in chile pepper, pecan, and other crops. This ongoing effort is in cooperation with the chile commission and industry.