Development and Dissemination of a Cowpea Cultivar for Cover Crops

Milt McGiffen (Research & Education Grant Program)

Western SARE Sustainable Agriculture Research & Education

USDA United States Department of Agriculture National Institute of Food and Agriculture

Project Number: SW02-034

Title: Development and Dissemination of a Cowpea Cultivar for Cover Crops

Principal Investigator :
Milt McGiffen
Extension Specialist
University of California
Dept. of Botany and Plant Sciences
Riverside, CA 92521-0124
(909) 560-0839
milt@ucr.edu

Cooperators:
Jeff Ehlers
Associate Research Specialist
University of California

Philip Roberts
Professor and Nematologist
University of California

SARE Grant: $43,686

Cowpea cover crop producing seed.

Situation:

Summer cowpea cover crops have proved to be a cost-effective means of enriching soil with carbon and more than 100 pounds of nitrogen per acre. They can also reduce pest populations, increase crop yields, and reduce weed emergence and herbicide dependence.

Spurred by rising fertilizer costs and fewer available pesticides, cowpea cover crop acreage in California and Arizona increased dramatically from virtually none in 1995 to several thousand acres today.

However, adoption of cowpea covers crops in the West has been slowed by the lack of varieties adapted to Western production systems. Growers and seed companies have identified the production of cowpea cover crop seed as a new crop opportunity that could increase profits and sustain smaller producers in depressed desert regions.

The ideal cowpea cover crop for the West would be resistant to nematodes, aphids, and wilt and compete well with weeds.

Objectives:

1. Identify cowpea cover crop cultivars that resist nematodes, cowpea aphid, Fusarium wilt, and shattering in the Western United States
2. Disseminate seed of improved varieties and related information through the California Foundation Seed Service and commercial seed companies
3. Demonstrate and optimize the merits of cover crops in specific cropping systems
4. Disseminate information about cover crops and their advantages and about seed production of cowpea as a new crop for limited-resource and other growers.

Cowpea cover crop trials found erect cultivars exhibit the greatest weed resistance.

Actions:

Early stages of the project focused on developing new cowpea genotypes that incorporate nematode resistance and other desirable agronomic traits. In 2006, seed of a promising cover crop was increased to 200 pounds, providing enough for large-scale grower trials.

Weed control is the greatest expense in producing many crops. Breeding for resistance to weeds is a concept often suggested but seldom tried. This project sought to breed for weed resistance using this approach:

- Twelve replacement series experiments were conducted with common purslane, a short-statured weed, and sunflower, a tall species, competing with one of six cowpea genotypes having similar vegetative vigor and maturity but with different growth habits. The weeds were selected to give the cowpeas different growth types against which to compete.
- There were 12 plants in each pot, and five proportions of two species (cowpea with sunflower or cowpea with purslane): 100:0; 75:25; 50:50; 27:75; 0:100.
- Dry weights of each species were obtained at harvest and aggressivity indices (AI) were calculated for each genotype and weed species.
- Growth analyses for the six cowpea genotypes, sunflower and purslane were performed, and the overall aggresivity indices were regressed against growth parameters to relate to plant competition and growth.

Results:

When grown with sunflower, erect and semi-erect cowpea genotypes had higher AI than prostrate genotypes. When grown with purslane, erect and prostrate genotypes had higher AI than semi-erect genotypes.

Differences in competitive ability were due to specific plant characteristics. Plant height was the cowpea trait most correlated with the ability to outcompete sunflowers. Specific leaf area and seed weight were also important determinants of the ability to suppress tall weeds. Larger initial size, higher position, and larger leaf area per unit of leaf weight allow competitive cultivars to capture more light and shade out sunflower. Efficient production of new growth, larger leaf area per unit leaf weight, and overall plant size gave cowpea a competitive advantage over low-growing purslane.

A model that simulates photosynthesis and other basic plant processes was validated for cowpea competition with purslane or sunflower. The model was used to study the effects of cowpea growth habit on final biomass production of cowpea and sunflower. It found that an erect growth habit was more competitive than the prostrate or semi-erect cowpea growth types.

Cowpea leaf area distribution had the greatest impact on cowpea biomass production when competing with sunflower, and the rate of growth of cowpea height was the greatest determinant of its ability to shade out sunflower.

From left, erect, semi-erect, and prostrate varieties.

Cowpeas typically attract a variety of insects, including aphids.

Potential Benefits:

The data have been used by cowpea breeder Jeff Ehlers to develop a new cultivar that incorporates weed resistance traits. The variety is essentially ready for release, although the project team would like one more year of grower trials and are happy to provide seeds to those interested.

Widespread adoption could have several benefits:

- As most cowpea cover crop seed is currently produced in the Southeast, developing a seed for production in the West could decrease transportation costs.
- The new genotypes created by this project will enable production of a cowpea cover crop in the low-elevation desert, creating new opportunities for growers and seed people.
- A new pest-resistant cover crop variety could increase profitability by decreasing reliance on synthetic pesticides and fertilizers.