Frank 61

Buhler, D.D., R.P. King, S.M. Swinton, J.L. Gunsolus and F. Forcella. 1995. Field evaluation of a bioeconomic weed management model. Agron. Abstr. pg. 51.

Approaches for Integration of Biological Control Into Weed Management Systems. R.J. KREMER, USDA-ARS and Univ. of Missouri, Columbia.

There is a current and urgent interest in developing reliable weed biocontrol strategies due to environmental and social concerns regarding herbicide use, chemical residues found in ground and surface waters, prolonged herbicide persistence in soils and development of herbicide resistance in weeds. The objectives of this report is to propose and to illustrate approaches to expand the roles of microorganisms in integrated weed management systems. Inoculant formulation is critical in establishing high populations in soil of microorganisms selected for attacking weed seeds and seedlings. Starch-based formulations provided >10^6 rhizobacteria per g soil and led to successful colonization of weed seedling roots. The applied rhizobacteria combined with competitive effects of soybean (*Glycine max*) successfully suppressed growth of associated foxtail species (*Setaria* spp.). Rhizobacteria introduced on seeds of cover and green manure crops readily established in soil and colonized weed seedling roots. Unique substrates included in formulations allow establishment of selected rhizobacteria or provided precursors for in situ phytotoxin production effective on weed seedlings. An ultimate integrated approach may include use of multiple strains or combinations of organisms to provide a wider array of biocontrol mechanisms, effectiveness under a broad range of soils and environments, greater persistence in the rhizosphere, and suppression of a broader range of weed species.

R.J. Kremer, (314) 882-6408

Soil organic matter: evaluating the relationship to litter quality by analysis of decomposition rates and the "light/large" SOM fraction. S.S. SNAPP* and S.A. MATERECHERA, Rockefeller Fdn, Malawi.

Physical size and density fractionation of soil organic matter (SOM) and a novel residue composition assay were used to evaluate soil amended with plant residues of varying quality. Long-term agroforestry sites in Malawi were monitored. Soils from hedge-row intercropping experiments at four sites represented mid-altitude sandy loams and sandy clay loams. Maize yields and residue biomass inputs over time provided independent measures of SOM quality. There were no differences in total SOM, but %C and %N in light/large fractions indicated that treatments improved soil: Gliricidia sepium> Senna spectabilis = 92 kg ha-1 N fertilizer> 0 N fertilizer control.

S.S. Snapp, Fax +265-782-835

GIS to Develop Area-Specific Fertilizer Recommednations in Malawi: Geo-referencing Soil Resources and Yield Potential. S.S. SNAPP* and T. BENSON, Rockefeller Foundation, Malawi.

A geographic information system (GIS) package was used to extrapolate from empirical fertilizer trials to area-specific fertilizer recommendations for maize production in Malawi, SE Africa. Soil nutrient levels at 250 sites were compared to soil type mapping units. Little relationship was found. Multivariate factor analysis and stepwise regression showed that use of diammonium phosphate was related to available P (Mehlich 3 extraction). Flexible fertilizer recommendations were developed that incorporated geo-referenced soil fertility and agro-climatic information in a decision tree. Farmers and extension agents tailor fertilizer recommendations, based on: 1) GIS map of regional maize yield potential; 2) GIS map of nutrient deficiencies; 3) expected N response (soil and plant characteristics observable by the farmer and/or an on-site nitrate test); and 4) crop management history of the field.

S.S. Snapp, Fax +265-782-835

Field Evaluation of a Bioeconomic Weed Management Model. D.D. BUHLER*, USDA-ARS, Ames, IA, R.P. KING, Univ. of Minnesota, S. M. SWINTON, Michigan State Univ., J.L. GUNSOLUS, Univ. of Minnesota, and F. FORCELLA, USDA-ARS, Morris, MN.

Field research was conducted at Rosemount, MN from 1991 to 1994 to evaluate a prototypic bioeconomic weed management model. In 1991, both seedbank- and seedling-based models resulted in similar weed control and corn yields with less herbicide use than a standard treatment. There were no differences in net margin among the model-generated and standard treatments. The models also reduced herbicide use compared to a standard in 1992. The seedling-based model resulted in weed control, corn yield, and net margin similar to the standard treatment. However, treatments based on the seedbank model yielded less corn than a standard treatment and had lower net margins. Seedbank-based treatments resulted in corn yields and net margin similar to the standard treatment in 1993, however, herbicide use was not always reduced. Corn yield and net margin was less using the seedling-based model than a standard treatment.

D.D. Buhler, (515) 294-5502

Policy and New-Crop Development. G.D. JOLLIFF, Oregon State University.

Surplus commodities and low prices have been frequent, and increasing, problems for US farmers during the past century, except for wartime. Crop yield increases portend a continuing need for profitable new crops if many farmers are to remain sustainable without government-financed commodity support programs. However, the high-risk and long-term nature of new-crop development generally limit private sector initiative. Thus, investment of public resources is essential to meet national needs. In the 1990 Farm Bill, Congress authorized creation of the The Alternative Agricultural Research and Commercialization Center (AARCC), with the purpose of encouraging and assisting research, development, and commercialization of new nonfood, nonfeed products from US agriculture and forestry. The AARCC, initiated in 1992, may represent an opportunity for progress in farm policy for strategic planning and new-crop development for long-term national needs. The AARC Center programs will be included in a discussion of historical and current policy needs for development of profitable new crops.

G.D. Jolliff, (503) 737-5849 email: jolliffg@css.orst.edu

Monitoring Phosphorus and Potassium Soil Tests on the Wisconsin Integrated Cropping Systems Trial (1989-1994). J.L. POSNER*, T.K. IRAGAVARAPU, J.O. BALDOCK, and T.A. MULDER, Univ. of Wisconsin.

Farmers are concerned about the effects of low-input cropping systems on soil fertility even on the historically rich and heavily manured and fertilized prairie soils of Wisconsin. Soil test P (STP) and K (STK) changes in the top 15 cm of soil profile are being monitored since 1990 in a large-plot cropping systems study at two locations in southern Wisconsin. The trial compares cash grain and forage-based rotations at varying levels of inputs. The initial STP and STK values were in the high to excessively high range at both sites (STP 59-89 mg kg^{-1} and STK 182- 238 mg kg^{-1}). No inorganic P or K fertilizers were applied in the low-input rotations. Dairy manure was applied at a rate of 22.4T ha^{-1} yr^{-1}, prior to the corn and seeding phases in the forage-based rotations. The STP levels dropped by a rate of 6 mg kg^{-1} yr^{-1} in the low-input cash grain [soybean (*Glycine max*)-Wheat (*Triticum aestivum*)/red clover (*Trifolium pratense*)-corn (*Zea mays* L.)] and forage (rotationally grazed) rotations at the Arlington site and by an average of 4 mg kg^{-1} yr^{-1} at the less productive Lakeland site. The STK values decreased at a faster rate than the STP values in the low-input rotations (8 to 22 mg kg^{-1} yr^{-1} at Arlington and 4 to 9.8 mg kg^{-1} yr^{-1} at the Lakeland site). These data suggest that although the low-input systems are "mining" the soil, they may remain economically competitive (gross margins $ 430) for at least another 15 years.

T.K. Iragavarapu, (507) 835-3620.

Monitoring Fall Nitrate Levels on the Wisconsin Integrated Cropping Systems Trial (1990-1994). J.L. POSNER*, T.K. IRAGAVARAPU, J.O. BALDOCK, and T.A. MULDER.

Minimizing the amount of inorganic N in the rooting zone following crop harvest reduces the potential for nitrate-N (NO_3-N) losses via leaching to groundwater. Soil NO_3-N levels in the top 90 cm of the soil profile are being measured since 1990 in six different cropping systems that consist of cash grain and forage rotations at two locations in southern Wisconsin. The soil type is a well-drained silt loam at both locations. Fall nitrates averaged 110-152 kg ha^{-1} for corn (*Zea mays* L.) following corn (R1) and 95-110 kg ha^{-1} for corn after soybean (*Glycine max*) (R2) fertilized according to best management practices. Fall nitrates were lowest (84-89 kg ha^{-1}) for corn in a 3-crop [soybean-wheat (*Triticum aestivum* L.) frost seeded with red clover (*Trifolium pratense*)] (R3) without any inorganic fertilizer N additions. Nitrates were highest (148-189 kg ha^{-1}) for corn grown after plowing down 3 year old alfalfa (*Medicago sativa* L.) (R4) and application of 44.8 T/ha of dairy manure followed by corn (125-128 kg ha^{-1}) after 2 years of alfalfa (R5) and 33.6 T/ha dairy manure application. Lowest amounts of nitrates (55-59 kg ha^{-1}) were measured following