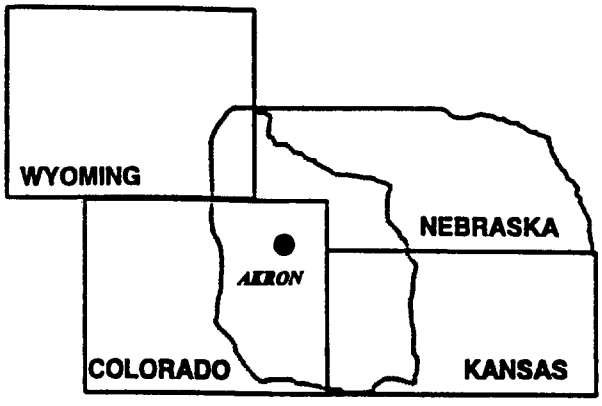
Alternative Rotations to Wheat - Fallow

Several new dryland cropping systems have emerged on the Great Plains in recent years as alternatives to the wheat-fallow system. According to researchers and producers who have adopted these systems, it is possible to increase the net income on a dryland farm by 10 to 30 percent or more.



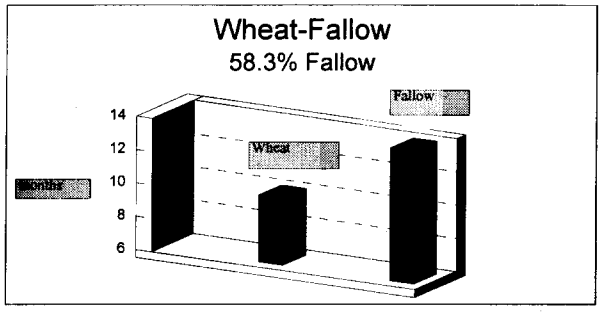
Area of Maximum Application

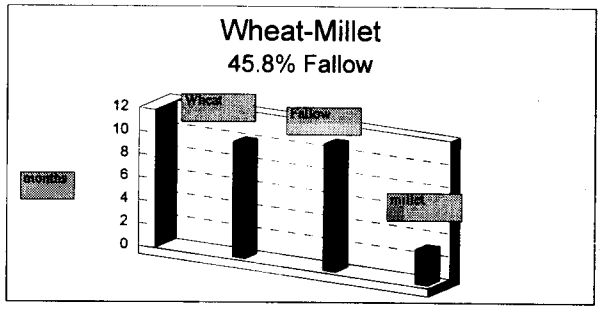
by: Manuel Rosales, Josh Saunders and Mike Sucik
USDA-NRCS Soil Quality Team, Akron, Colorado
Gene Uhler - USDA-ARS
Don Nitchie - CSU Extension Service
September, 1996

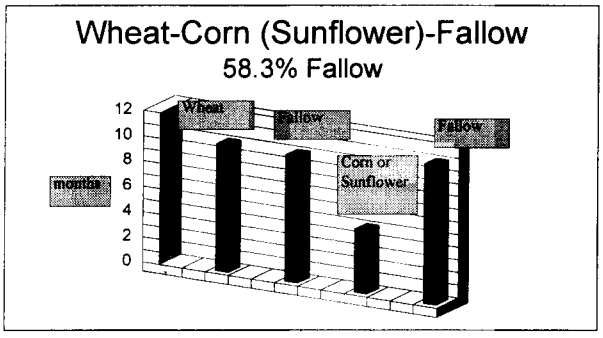
PERIODS OF MOISTURE RECHARGE IN MULTI-YEAR CROP ROTATIONS

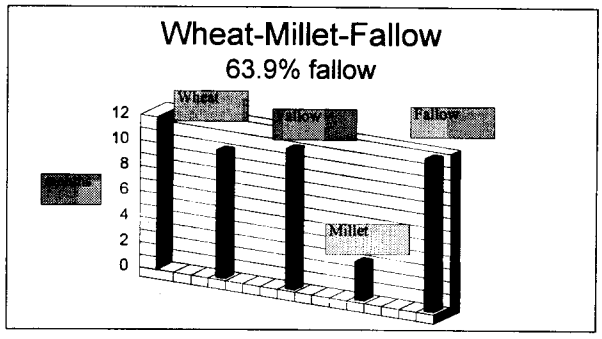
One of the major concerns when going to a multi-year crop rotation is moisture. Producers are concerned that spring crops will deplete soil moisture needed for wheat. The following charts show that some multi-year rotations actually increase the total fallow period over the length of the rotation. The fallow periods for the multi-year rotations are in late fall and early spring when the majority of precipitation occurs. During the warm summer months, the soil is shielded from heat and wind by crops and greater amounts of residue, reducing evaporation losses, allowing more soil water for plant growth.

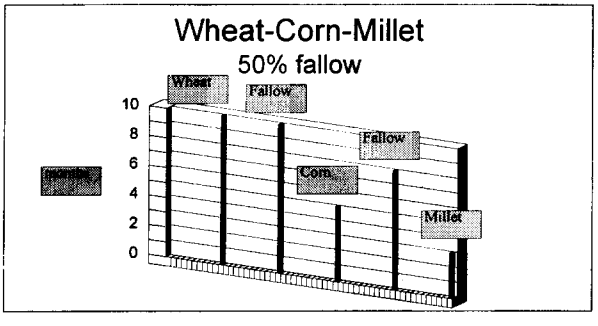
Rotation	% Time Fallowed
Wheat-Millet-Fallow	63.9
Wheat-Corn-Millet-Fallow	62.5
Wheat-Corn (Sunflower)-Fall	58.3
Wheat-Fallow	58.3
Wheat-Corn-Millet	50.0
Wheat-Millet	45.8

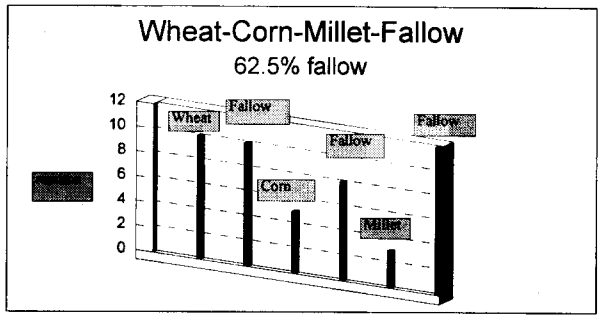












Wheat growing period---Sept - July
Millet growing period---June - Sept
Corn (Sunflower) growing period---May - Oct

ECONOMICS OF MULTI-YEAR CROPPING SYSTEMS

The following table demonstrates yields and annualized net returns for the three year period of 1993-95 at the ARS-Central Great Plains Research station at Akron, Colorado. The yields reported are actual. Different producers may want to use higher or lower operation costs that reflect their operation to calculate returns.. Change in commodity prices will also affect returns.

1993-95 Summarization of Alternative Crop Rotation (ACR)

Average Pounds over all Treatments for each Rotation

Rotation	Crop	Tillage cost of $5.00 each pass (Fallow)	Seed and planting	Fertilizer 50 lb. N at $0.18 & application	Spray	(1) Custom 13&13>2 harvest	(2) Operating cost	LBS/AC 3 year average	(3) Net $	(4) Annualized Net $	
W-F	W	30.00	13.00	14	5.50	20.28	82.78	**2281**	69.29	**34.64**	
W-M	W		12.00	14	21.00	16.16	54.16	**1331**	25.57		
M-W	M		10.00	14	7.00	26.47	65.47	**1793**	59.08	**42.32**	
W-M-F	W	25.00	12.00	14	5.50	20.62	77.12	**2357**	80.01		
M-F-W	M		10.00	14	7.00	24.91	55.91	**1494**	41.20	**40.40**	
W-C-F	W	20.00	12.00	14	6.00	21.41	73.41	**2543**	96.12		
C-F-W	C		22.00	14	26.00	19.90	81.9	**2045**	18.52	**38.22**	
W-SUN-F	W	15.00	12.00	14	6.00	20.26	67.26	**2274**	84.34		(5)
SUN-F-W	SUN	5.00	16.50	14	15.19	17.98	68.67	**874**	31.88	**38.73**	
W-C-M	W		12.00	14	15.50	16.12	57.62	**1318**	30.25		
C-M-W	C		22.00	14	26.00	19.18	81.18	**1890**	11.63		
M-W-C	M		10.00	14	12.00	26.69	62.69	**1835**	56.59	**32.82**	
W-C-M-F	W	20.00	12.00	14	5.50	21.94	73.44	**2663**	104.09		
C-M-F-W	C		22.00	14	26.00	20.14	82.14	**2098**	20.89		
M-F-W-C	M		10.00	14	12.00	25.27	61.27	**1562**	40.26	**41.31**	

(1) 13 &13>20 = $13 for first 20 bushels, $0.13 for all bushels over 20 bushels and $0.13 per bushel for hauling up to 10 miles

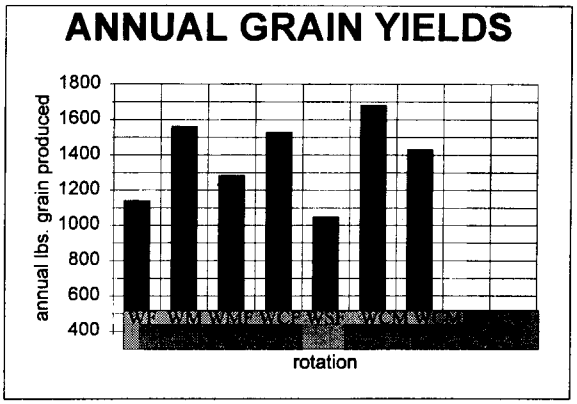
(2) Operating costs = tillage + seed & planting + fertilizer & application + spraying + harvest

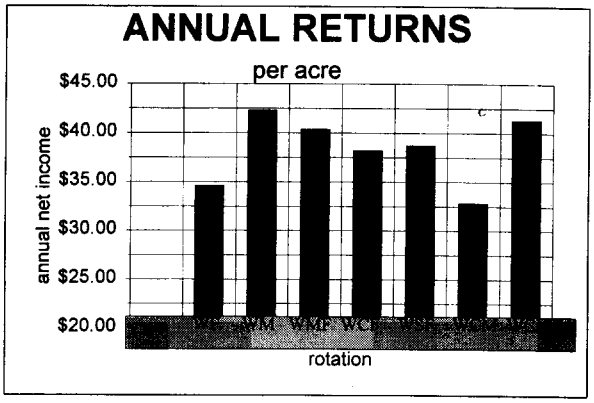
(3) Example (Net $=lbs. wheat / 60 lbs. per bushel * $4.00 per bushel - operating cost)

(4) Annualized net basis income of crops ÷ length of rotation: Example: (W-C-F=income of wheat + income of corn ÷ 3)

(5) Only a two year average

W. WHEAT - Harvest reported at 12% moisture, 60lb. bushel
CORN - Yield reported at 15.5% moisture, 56lb. bushel
MILLET - Yield reported at 12% moisture, 50 lb. bushel
SUNFLOWERS - Yield reported at 10% moisture, 30lb. bushel
PRICE PER BUSHEL USED: Wheat $4.00, Corn $2.75, Proso Millet $3.25, Sunflower per 100 lb. $11.50
Spray column is very subjective as to each individuals rates and weed problems.
Swathing for proso millet figured at $6.75 / acre which was added to millet harvest cost.
No land or machinery costs used in calculations.





This chart compares the annual amounts of grain produced under different rotations during the period 1993-95.

This chart compares net annual returns of different rotations during the period 1993-95. The price of commodities was estimated using long term averages and may not reflect what the actual grain prices were during this period.

WF= Wheat-Fallow
WM= Wheat-Millet
WMF=Wheat-Millet-Fallow
WCF=Wheat-Corn-Fallow
WSF=Wheat-Sunflower-Fallow
WCM=Wheat-Corn-Millet
WCMF=Wheat-Corn-Millet-Fallow

MULTI-YEAR CROP ROTATION LEASES

Colorado State University extension specialists have estimated that under Northeast Colorado multi-year crop rotations, total operating costs may increase by over 60 percent due to all the inputs and different equipment needed to raise crops other than wheat. When leasing cropland, before a new system is adopted, it is best for a landlord and tenant to jointly decide on adopting the new technology. If they both agree, **a new lease should be developed to determine fair shares for a new set of operating expenses.**

Typically, the wheat-fallow lease includes a one-third share for the landlord and two-third shares for the tenant with the landlord contributing one-third the cost of fertilizer and basically one-third of the total costs.

160 Acres; 80 ac. Wheat, 80 ac. Fallow	Annual Charge	Landlord	Tenant
Land (annual@4%)	$2,330	$2,330	$0
Real Estate Taxes	$426	$426	$0
Fertilizer	$872	$288	$584
All other costs (seed, fuel, machinery, herbicide, labor, management, etc)	$5,296	$0	$5,296
Total	$8,924	$3,044	$5,880
% of Total		34%	66%

Under a Wheat-Corn-Fallow system, a landlord may contribute one-third the cost of fertilizer, but the balance of total costs becomes significantly more disproportionate.

160 Acres; 53.3 ac. Wheat, 53.3 ac Corn, 53.3 ac Fallow	Annual Charge	Landlord	Tenant
Land (annual@4%)	$2,330	$2,330	$0
Real Estate Taxes	$426	$426	$0
Fertilizer	$1,898	$633	$1,265
All other costs (seed, fuel, machinery, herbicide, labor, management, etc.)	$10,286	$0	$10,286
Total	$14,940	$3,389	$11,551
% of Total		23%	77%

To resolve this imbalance, the shares of the crop could be changed to one-fourth for the landlord and three-fourths for the tenant or a new lease could be developed with the landlord contributing to more of the yield affecting costs.

160 Acres; 53.3 ac Wheat, 53.3ac. Corn, 53.3 ac. Fallow	Annual Charge	Landlord	Tenant
Land (annual @4%)	$2,330	$2,330	$0
Real Estate Taxes	$426	$426	$0
Fertilizer	$1,898	$633	$1,265
Seed	$891	$297	$594
Herbicides	$1,499	$499	$1000
All other costs (fuel, machinery, labor, management, etc.)	$7,896	$0	$7,896
Total	$14,940	$4,185	$10,755
% of Total		28%	72%

In this example, the landlord contributed to the cost of seed and herbicides and was still unable to reach the desired level of one-third the operating costs. Either additional costs could be shared such as insecticides and custom spraying, or the shares of crops could be adjusted.

Use 3-5 year averages when determining operating costs to eliminate year to year variability. Cash leasing may also be an option where a landlord does not want to share the additional costs. No matter what leasing arrangement a landlord and tenant have, good communication should be maintained. Tenants should keep the landlord informed of costs, weather conditions, yields, and prices to insure a fair lease for both parties.

ADVANTAGES AND DISADVANTAGES OF MULTI-YEAR CROP ROTATIONS

Advantages	Disadvantages
Higher net returns.	Greater cash flow requirements.
Land is better protected from erosion.	Cooler, wetter soil in spring.
Weed, insect, and disease cycles are disrupted	New challenges for weed, insect, and disease control
More residue equals more moisture trapped	Requires additional equipment.
More efficient use of moisture.	More intensive management and knowledge required
Spreads out risk of hail damage.	Spreads out risk of hail damage.
More efficient use of nutrients---Less leaching.	May need to renegotiate leases.
Builds soil organic matter levels.	

Evidence indicates that multi-year cropping systems do work in areas that were previously thought to support only wheat-fallow rotations, however changing rotations and farming practices is a major land use decision. BEFORE MAKING ANY COMMITMENT TO MULTI-YEAR CROP ROTATIONS, MUCH RESEARCH IS NEEDED TO DETERMINE WHETHER THIS TYPE OF SYSTEM SHOULD BE ADOPTED. The information in this report only covers a few of the aspects of multi-year cropping systems. Operations vary from producer to producer and climate and soil type can vary significantly over short distances, so one should look at every aspect of their operation before reaching a decision.

For more information on alternative cropping systems see:

1. Peterson, G.A., D.G. Westfall, L. Sherrod, R. Kolberg, D. Poss 1995. Sustainable Dryland Agroecosystem Management. Colorado State University Ag. Exp Sta. Technical Bulletin TB95-1.

2. Peterson, G.A.,D.G. Westfall, N.E. Toman, R.L. Anderson 1993. Sustainable Dryland Cropping Systems: Economic Analysis. Colorado State University Ag. Exp.Sta. Technical Bulletin TB93-3.

3. Vigil, M.F. 1995. Fertilization in Dryland Cropping Systems: a brief overview. Conservation Tillage Fact Sheet #4-95. USDA-ARS and USDA-NRCS, Akron, Colorado.

4. Vigil, M.F., D.C. Nielsen, Cindy Johnson. 1996. Cost of Production and Yields of Alternative Dryland Crops. (draft) USDA-ARS, Akron, Colorado.

5. Vigil, M.F., D.C. Nielsen, R.L. Anderson, R. Bowman. 1995. Taking advantage of the Benefits of No-till with Rainfall Probability Distributions. Conservation Tillage Fact Sheet, USDA-ARS and USDA-NRCS, Akron, Colorado.

6. Bowman, R. and M. Petersen, 1996. Soil Organic Matter Levels in the Central Great Plains. Conservation Tillage Fact Sheet #1-96, USDA-ARS and USDA-NRCS, Akron, Colorado.

7. Nielsen, D.C., 1996 Estimating Corn Yields From Precipitation Records. Conservation Tillage Fact Sheet #2-96, USDA-ARS, USDA-NRCS, and Colo. Cons. Till Assoc., Akron, Colorado.

8. Johnson, J.J., J.F. Shanahan, C.L. Johnson. 1996. Colorado Corn Performance Trials,1995. Colorado State University Ag. Exp. Sta. Technical Report TR96-2.

9. Nielsen D.C. and S.E. Hinkle, 1996. Field Evaluation of Basal Crop Coefficients for Corn Based on Growing Degree Days, Growth Stage, or Time. Transactions of the ASAE Vol. 39(1):97-103.

10. Baltensperger, D., D. Lyon, R. Anderson, T. Holman, C. Stymiest, J. Shanahan, L. Nelson, K. DeBoer, G. Hein, J. Krall, 1995. Producing and Marketing Proso Millet in the High Plains. University of Nebraska Cooperative Extension EC 95-137-C.

11. Halvorson A.D., R.L. Anderson, S.E. hinkle, D.C. Neilsen, R.A. Bowman, and M.F. Vigil, 1994. Alternative Crop Rotations To Winter Wheat-Fallow. USDA-ARS, Akron, Colorado.

12. Armstrong, J.S., S.D. Pilcher, and B.C. Kondratieff, 1995. Two Chloropid Flies Infesting Proso Millet in Northeastern Colorado. Journal of the Kansas Entomological Society 68(4), 1995, pp.478-480.

13. Anderson R.L., 1994. Planting Date Effect on Proso Millet. J. Prod. Agri., Vol 7:454-458.

14. Baltensperger, D., G. Frickel, M. Swanson, T. Holman, R. Klein, J. Krall. and R. Anderson, 1995. Nebraska Proso, Safflower, Sunflower and Amaranth Variety Tests 1994. University of Nebraska Cooperative Extension EC 94-107-A.

15. Vigil, M.F., D.C. Nielsen, A. Halvorson, and B. Beard. Dryland Canola Production: Variety Selection, Nitrogen Response, and Water use in the Central Great Plains. USDA-ARS, Akron, Colorado.