THE ROLE OF ALFALFA IN SOIL CONSERVATION

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Due to its many benefits, alfalfa has earned its reputation as "Queen of the Forages". Some of alfalfa's advantages are 1) very high nutritional value for all classes of livestock, 2) adaptability to a wide range of soils and growing conditions, 3) flexibility in being able to be grown alone or with grasses, 4) to be harvested for hay, silage or pasture, 5) strong seedling vigor and 6) high yields.

Alfalfa also should be rated "Queen of the Forages" as a crop for the soil. In addition to its many other benefits, alfalfa is an excellent choice for soil improvement because of its abilities to reduce soil erosion, especially when compared to annual row crops, improve soil tilth and add high levels of nitrogen.

Soil erosion is a process of soil detachment, movement and deposition. Water is the most important cause of soil erosion for Kentucky. Raindrops can fall at speeds approaching twenty miles per hour. They "explode" against unprotected soil, creating tiny craters and splashing detached soil as high as three feet into the air and as far away as five feet. Moving water may also detach soil particles when the velocity is great enough.

Soil transport happens when the water striking the soil begins to move in thin sheets across the soil surface. The soil particles broken loose by the raindrops are carried away from the point of detachment. As slopes get longer and steeper, water velocity and volume increases, thereby increasing its ability to carry more soil.

Soil deposition occurs when the flow of water decreases. This can be a few feet from where detachment occurred or as far away as entirely off the field (offsite). Drainage ways can be blocked or bodies of water can be polluted.

One of the biggest effects is on the property of the soil itself. Some of these are 1) loss of organic matter, 2) degradation of soil structure, 3) loss of minerals containing plant nutrients, and 4) exposure of subsoil with its lower fertility and higher acidity. A major consequence of these effects is a reduction of the soil's water supplying capacity.

Erosion removes a field's original topsoil causing the subsoil to mix with the remaining topsoil during conventional soil preparation. This subsoil often has more clay, less organic matter, lower available water holding capacity and lower fertility status.

As the clay content increases, the soil has a lower plant-available water-holding capacity than soils high in silt or soils with a well-proportioned amount of sand, silt and clay. The plant cannot use as much of the water held in the soil. This is one of the biggest negative factors of soil erosion.

How is soil erosion reduced? The major way is to prevent soil detachment by using vegetative cover. As a secondary benefit, vegetative cover reduces and slows the flow of runoff water which reduces the transport of soil particles.

Vegetative cover can be increased by growing perennial forages such as alfalfa in place of or in rotation with annual row crops. In addition to intercepting raindrops and slowing runoff, alfalfa can add organic matter which improves soil tilth and add nitrogen to the soil while at the same time providing a profitable crop.

Workers at the University of Missouri have analyzed mail-in-records from crop producers in Missouri from 1974 to 1982 and have found alfalfa to be economically competitive with other crops.

Eight Year Average Gross Returns, Non-Land Costs, and Net Land Returns for Major Farm Crops (1974-1981)

	Per Acre Cost & Return			Rank in Net
Crop	Gross Return	Non-land Costs[1]	Net-land Return[2]	per Acre Return
Soybeans	$ 186	$ 102	$ 84	1
Corn (grain)	194	160	34	5-6
Corn (silage)	214	171	43	3
Grain Sorghum	150	116	34	5-6
Wheat	124	86	38	4
Alfalfa Hay	185	134	51	2

[1]Includes all per acre costs other than interest on land value.
[2]Net return in excess of all costs, other than interest on land investment.
SOURCE: V.E. Jacobs and Carrol L. Kirtley, University of Missouri Farm Management Newsletter, FM82-8, August 1982.

Alfalfa ranked second only to soybeans in net land return over the eight year period. When consideration is given to soil loss, alfalfa shows an even higher ranking.

Eight Year Average MIR Net Land Returns, Estimated Soil Losses, and Returns Per Unit of Soil Losses

Crop	8 Yr. Avg. Net Land Return	Estimated Soil Losses in Tons per Acre	Net Return per Ton of Estimated Soil Loss
Soybeans	$ 84	14 to 35	$ 2 to 6
Corn	34	13 to 25	1 to 3
Corn Silage	43	14 to 30	1 to 3
Grain Sorghum	34	13 to 25	1 to 3
Wheat	38	8 to 13	3 to 5
Alfalfa Hay	51	2 to 4	13 to 25

SOURCE: V.E. Jacobs and Carrol L. Kirtley, University of Missouri Farm Management Newsletter, FM82-8, August 1982.

Researchers at the University of Missouri feel that pure stands of alfalfa have not been recognized for their ability to control erosion. They conducted field studies on defined plots of Mexico silt loam soil with a 3 to 3.5% slope using confinement basins. These plots were 10.5 feet wide by 90 feet long. The surface runoff and sediment were collected for each rainfall event.

During establishment, erosion occurred with a severe runoff event on the alfalfa plot immediately after making the pure seeding but was less than from the fallow or soybean plots. Little erosion occurred after seedlings reached 12 - 16 inches in height. See figure 3, (from Soil Erosion From Pure Stands of Alfalfa During and After Establishment by J.H. Coutts, C.J. Nelson, University of Missouri and D.L. Rausch, USDA-ARS Watershed Research Unit, Columbia, Missouri).

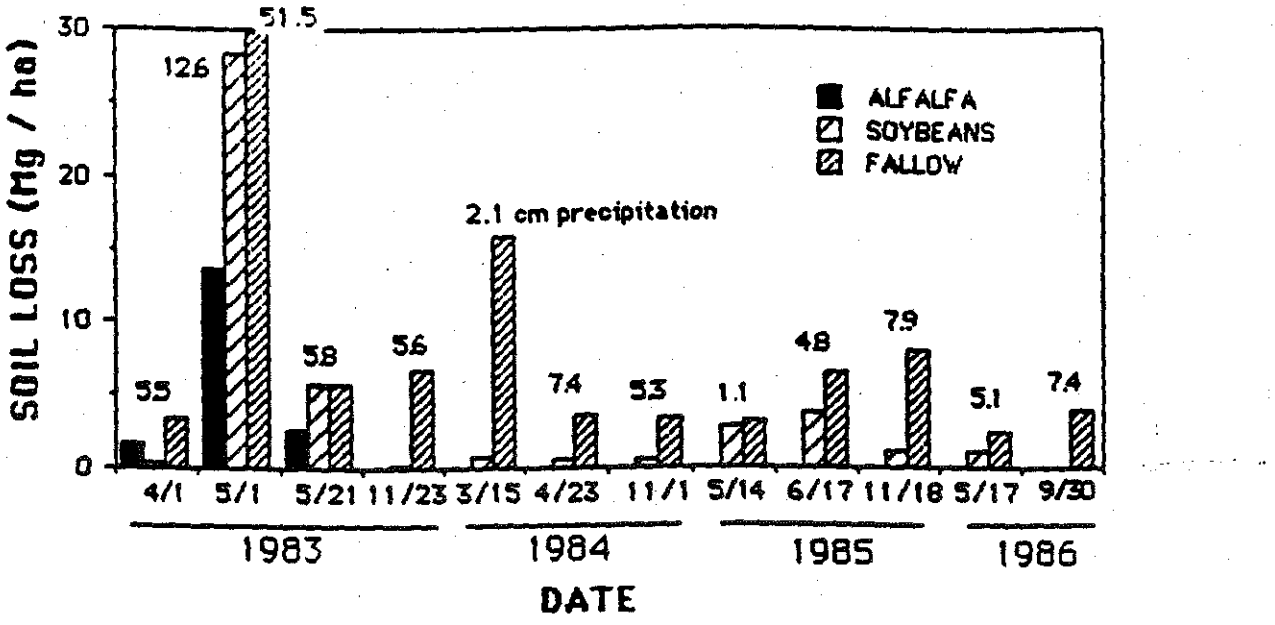

Figure 3. Precipitation and soil loss from alfalfa, conventionally-tilled soybeans and fallow during 12 largest storms for 1983-1986.

During the latter half of the establishment year and the next three years, the pure stand of alfalfa had no measurable soil loss. Similar plots of conventionally tilled soybeans and of fallow soil had losses of 2 tons per acre per year and 11.6 tons per acre per year, respectively. See figure 4, (from Soil Erosion From Pure Stands of Alfalfa During and After Establishment by J.H. Coutts, C.J. Nelson, University of Missouri and D.L. Rausch, USDA-ARS Watershed Research Unit, Columbia, Missouri).

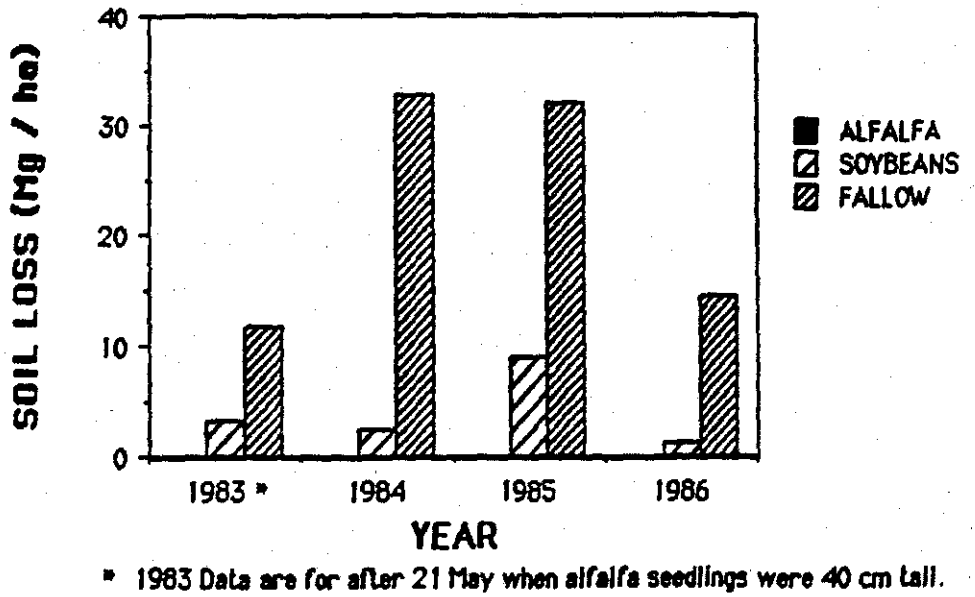

Figure 4. Total soil loss from alfalfa, conventionally-tilled soybeans and fallow plots for the last half of 1983 and for each year through 1986.

In another study at West Plains, University of Missouri researchers are examining yield and plants per square foot for their effect on stand persistence. On a nearly ten year old stand, (1981-1990), it has been found that 180 pounds of K_2O and 60 pounds of P_2O_5 per year resulted in as good a yield as twice the amount of P_2O_5 and K_2O.

Figure 5 (from P and K Requirements for High Yielding Alfalfa on a Low P and K Soil in South Central Missouri by Dr. Daryl D. Buchholz) shows that with 0 K_2O, plants per square foot dropped to near zero while 180 and 360 pounds of K_2O per acre resulted in 1 to 1.5 plants per square foot.

Work is continuing to determine at what plant density will soil loss begin to occur. The University of Missouri is going to monitor the stands a few more years in an attempt to answer this question.

In summary, erosion reduces the soil's ability to maintain productivity over the long term. Cropping systems which prevent soil detachment and transport can reduce erosion. Work at the University of Missouri indicates that alfalfa is effective at reducing erosion when comapred to conventional row crops and at the same time offers economic advantages. One of the main factors in the ability of alfalfa to reduce erosion is the life of the stand. The longer the stand, the less exposed the soil due to less frequent establishment needs. It seems

that the good agronomic practices required for maximum alfalfa production that have been discussed for many years also increase the ability of the forage to reduce erosion. Also, with the advent of new, disease resistant varieties, stand life should improve.

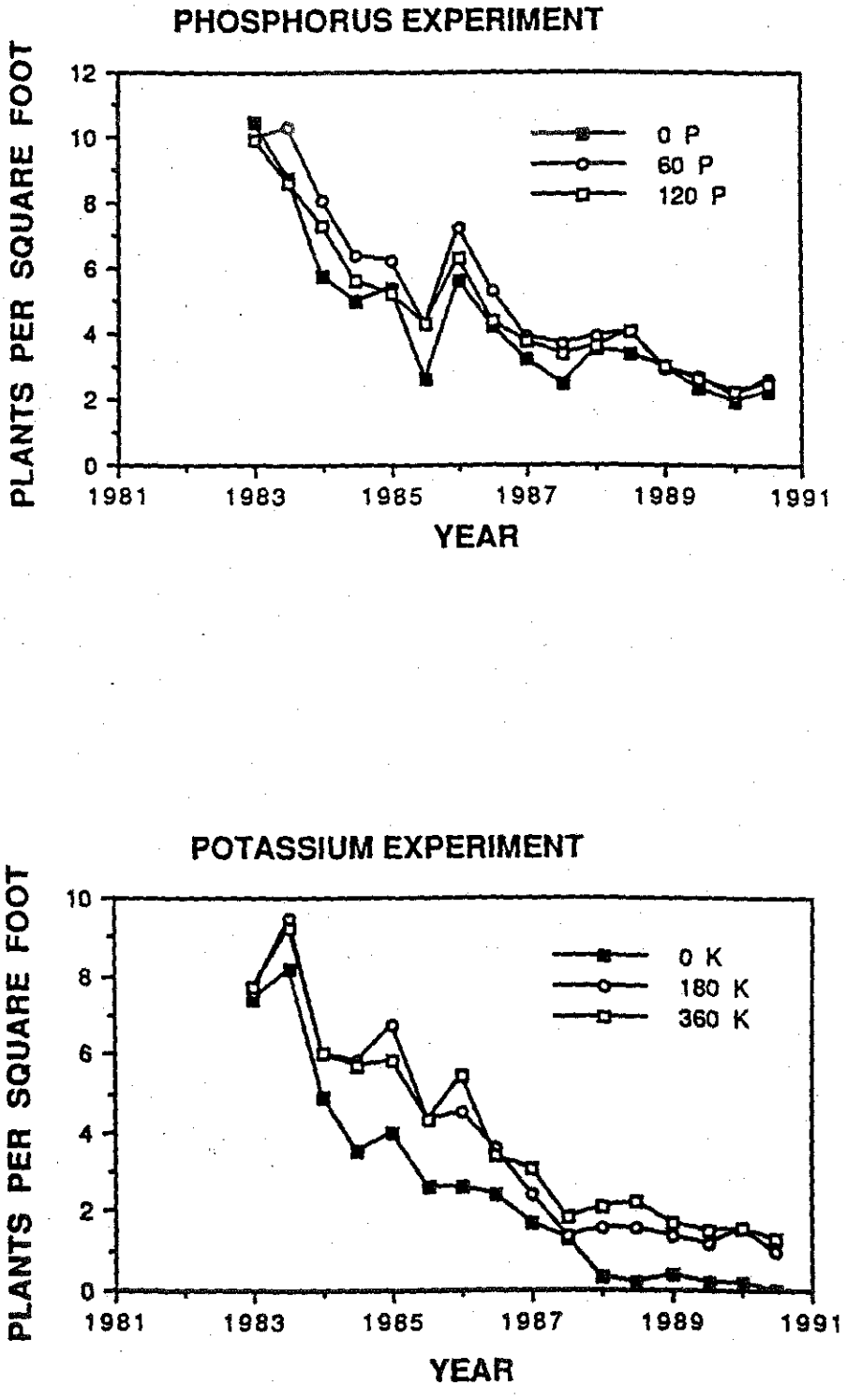

Figure 5. Plants per square foot for three fertility rates of P and K over time.