Viewpoint: Forage and Range Research Needs in the Central Great Plains

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Abstract

In the central Great Plains, pastures and rangelands are not economically competitive with grain crops. This has led to increases in acreages of row crops at the expense of rangelands, pastures, and hay crops on marginal lands resulting in severe erosion problems. The productivity of forages, pastures, and rangelands needs to be increased to levels that would make them economically competitive with grain crops. Innovative research will be needed to develop the required knowledge and technology upon which productivity increases can be based. Pastures and rangelands in this area are usually components of production systems which may also include the feeding of hay, silage, crop residues, and other feeds. Coordinated research teams need to be formed that can focus on all components of these production systems. Research needs and objectives of these research teams can be categorized by the land capability classes of the three major ecological regions in this area, the tall-grass, mid-grass, and short-grass prairie. In all of these regions, a classification system that is production-oriented rather than climax-oriented is needed for both pastures and rangelands if effective control of soil erosion and optimal income per land unit are to be achieved. Interstate cooperation in establishing a research team for major ecological region would facilitate the most efficient use of research resources.

Increases in the productivity of pastures and rangelands have been small in comparison to the increases that have been achieved with grain crops. This difference in the increase in productivity can be attributed in part to the small percentage of total research funds that have been allocated to forages.

Because of differences in profitability between forage and grain crops, pastures and rangelands in many instances are not economically competitive with grain crops (Wight et al. 1983). This has led to increased acreage of row crops at the expense of pasture and hay crops on marginal lands, resulting in severe erosion problems (Larson et al. 1983). Extensive areas of range and pasture land in the Great Plains have been plowed in recent years for use in both dryland and irrigated crop production (Laycock 1983, Powers et al. 1983).

The philosophy that native climax vegetation is optimal may have contributed to the plateauing of rangeland productivity and limited productivity to that level. This doctrine also has tended to discourage creative research on rangelands because research has been focused on management towards climax, and suggestions that other concepts and research approaches may be required (Love 1961) have been viewed as heresy (Dyksterhuis 1962, Sampson and Burcham 1963).

Pastures and rangelands in the central Great Plains are usually components of production systems which may also include the feeding of green chop, hay, silage, haylage, and crop residues. A large percentage of the beef production units in this area are integrated rangeland-crop unit systems (Wight et al. 1983). Past research has focused on various units of the systems, and the lack of coordinated study of all system components has limited overall gains in productivity. Previous reports on range research needs in the Great Plains have either focused on the range component of the forage production system (Klemmedson et al. 1978) or they have not targeted production goals in terms of alternate uses of land (Great Plains Agr. Comm. 1976, SEA-AR 1981).

Increased productivity of forage crops, particularly pastures and rangelands, in the central Great Plains, is essential because a large proportion of the nation's beef is produced in this area. This region is also one of the nation's areas that is most susceptible to soil erosion. It was part of the 'dust bowl' in the 1930's. Most of the land in this area, including rangelands, is privately owned, and profits, not good intentions, pay the taxes.

The productivity of forages, pastures, and rangelands must be increased to a level that is economically competitive with grain crops grown on the same land. In the past, farmers have been paid by government set-aside programs to put land subject to erosion into grasslands. However, as soon as grain prices increased, these lands were plowed. One way to prevent this cycle from repeating itself is to make forages, pastures, and rangelands more profitable. Profitability is dependent upon productivity and input costs. Increases in productivity on forage-producing lands can be achieved by the use of improved, highly productive forage plants with improved forage quality and increased disease and pest resistance, and by the use of improved, integrated management systems. Innovative research is required to develop the required knowledge and technology. This research should be conducted in coordinated team research programs on all components of the production system. Cooperative efforts involving teams at various locations will enhance research progress. The profitability and erodability of land units can be classified by land capability classes (Klingebiel 1958). Forage, pasture, and range research can be linked to land capability classes once the type of forage crops that can be profitably grown on a unit of land is usually dependent upon the capability classification of that land.

In the central Great Plains, most class I and II land has been and will continue to be used for grain production. In general, forages that can economically compete with cash crops on this land are alfalfa, corn for silage, forage sorghums, sorghum-sudangrass hybrids, and sudangrass. Research on forages for class I and II land should emphasize these crops. Extensive research is being done with alfalfa as a harvested forage but much more could be done to improve this valuable, soil-improving crop as a pasture and range plant.

Corn is both a major grain and forage crop. Most of the current research on corn is for use as a grain crop. Corn produces a high quality silage because of its high grain content. Its value as a forage could be improved if the forage quality of the stover component of the silage were also improved. This could be done by developing improved germplasm and with better ensiling procedures. It appears that minimal effort is being devoted to breeding improved corn hybrids for use as corn silage. The stover of corn grown for grain also is used extensively as livestock feed, particularly for wintering beef cows. Research is needed to improve stover quality.
implementing conservation practices. Greater productivity and
described a system of classifying rangelands that establishes pro-
can be developed (Love 1961). Wilson and Tupper (1982) have
should be adopted as the basis for planning range research and for
expression of this genetic potential. This research will require the
rangeland conditions:

- Class III and IV land moves in and out of forages as the relative
  prices of grain and livestock change (Wight et al. 1983). Class III
  land can be used for grain crops if conservation tillage and other
  conservation practices are used. Class IV land should be kept in
  permanent pastures but is frequently cultivated when grain prices
  are high. Perennial grasses and legumes need to be developed for
  both classes of land that are productive enough so that they are as
  profitable as grain crops even when the price of grain is high. This is
  an attainable research objective. To be competitive, these forage
  plants must be capable of being established in one growing season
  and must produce forage yields during the first season that are at
  least 50% of full production, which must be achieved during the
  second growing season. This productivity goal can be reached by
  the development and use of strains with improved establishment
  capability and by reducing competition from all other sources
  including weeds and insects. This rapid establishment capability
  already has been achieved by using atrazine as a pre-emergence
  herbicide to establish switchgrass (Panicum virgatum L.) and big
  bluestem (Andropogon gerardii Vitman) (Martin et al., 1982) and is
  highly feasible with other warm-season grasses having seeding
  atrazine tolerance (Baehler et al., 1984). Currently, technology is
  available to double the productivity of many pastures and range-
  lands, but to be competitive with grain crops, the productivity of
  forage plants on class III and IV land will have to exceed that which
  is possible with current technology. This goal can be achieved by
developing improved germplasm with the potential for increased
  yields, quality, and insect and disease resistance and by concur-
 rently developing management systems that will maximize the
  expression of this genetic potential. This research will require the
  input of plant breeders and geneticists, forage quality scientists,
  entomologists, plant pathologists, soil scientists, and animal
  nutritionists.

The productivity of class V-VII land can also be greatly
improved. Unmodified class V, VI, and VII land is usually des-
cribed as rangeland. Rangeland occupies up to one-half of the total
land area of some states in the central Great Plains. Rangeland
improvement has been hindered by the criteria currently used to
classify range conditions which place native 'climax' vegetation in
the 'best' category. Progress in improving the productivity of range-
lands could be enhanced if it were generally recognized that range-
land is simply a class of agricultural land for which superior plants
can be developed (Love 1961). Wilson and Tupper (1982) have
described a system of classifying rangelands that establishes pro-
ductivity and soil stability as the criteria for determining range
conditions. Based on these criteria, they describe the following
rangeland conditions:

1) excellent condition: soil stable, productivity good;
2) good condition: soil stable, productivity diminished;
3) fair condition: soil unstable, productivity good;
4) poor condition: soil unstable, productivity diminished.

This production-oriented classification system is needed to improve
the productivity of privately owned pasture and rangeland, and it
should be adopted as the basis for planning range research and for
implementing conservation practices. Greater productivity and
profitability would make the return per unit of land in permanent
forages more competitive with alternate land uses such as cultivation
for dryland wheat production. Climax vegetation may be the
type of vegetation that will be the most productive in many areas
but this assertion should be based on research and not on
philosophy.

In the near future, it is highly likely that herbicides will be
developed that will make it possible to economically seed improved
grases and legumes directly into range without plowing.
Drills capable of seeding directly into unplowed rangelands are
already available. Adapted grasses and legumes that are more
productive than native range plants could then be seeded without
soil loss. Again the grasses and legumes must be capable of being
established in one growing season. Breeding range grasses and
legumes for improved yield and quality could lead to doubling beef
production per acre. A new switchgrass variety with 6% higher
in vitro dry matter digestibility (IVMD) than a standard variety
produced 35% more beef per land unit over a two-year period in
Nebraska even though the two strains produced the same amount
of forage (Ward et al. 1984). Further increases in yield and quality
can be made in switchgrass and other grasses.

Improved management practices could add additional gains in
productivity. If soil fertility is the major limiting factor, fertili-
tization can greatly improve productivity. To maximize productivity
per land unit, both improved grasses and legumes will be needed.
Ideally, rangeland managers need to have the capability to remove
undesirable species with herbicides or biological agents and to
replace them with improved cultivars of desirable plants without
damaging existing desirable species. Improved cultivars can be
developed from native climax species or introduced species that
have resilience to climatic fluctuations similar to that of native
climax vegetation.

The use of complementary forages and reseeded pastures and
rangeland to improve productivity and profitability of livestock
production units is well documented (Cordingly and Kearl 1975,
Rogler and Lorenz 1983, Hart et al. 1983, McIvain and Shoop
1973, Grey 1973). New research developments should be evaluated
in terms of their overall effects on production systems in addition
to their effects on components of those systems, i.e., pasture, hay,
or range. In addition to research on plants, there also is a need for
research on animal-plant interactions. This includes investigations
of grazing systems and genetic research with animals to develop
strains that are more productive than current breeds as measured
in terms of meat produced per land unit. The current interest in
unconventional grazing systems is encouraging, but verifiable
research results and not unsubstantiated opinions should be the
basis for designing and implementing grazing systems.

It is obvious that expanded forage and range research efforts will
be required to make the necessary scientific breakthroughs.
Research is expensive and the more complex and difficult the
problem, the greater the cost to solve that problem. It is unlikely
that individual states, many of which have small populations and
modest research budgets, will have the resources to develop the
necessary research teams. Public officials and private citizens need
to recognize that these are regional problems and that funding
should be pooled to establish the required teams. Since there are
three major ecological regions in this area, the tall-grass,
mid-grass, and short-grass prairie (Carpenter 1940), it seems likely that
the most research progress could be made if research teams were
developed for each region. This need for interdisciplinary research
tests was documented in a previous review of range research in the
western United States (SEA-AR, 1981). Cooperation among all
public research agencies will need to be improved at all levels of
management to permit the establishment of these research teams.

References

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