# The role of the Universities of Wyoming and Nebraska in the development of alternative crops for the US High Plains.

**James Krall**[1], David Baltensperger[2], David Koch[3], Drew Lyon[2], Jerry Nachtman[1], Glen Frickel[2], Jack T. Cecil[1], Jim Margheim[2], Eric Nielsen[2] and Jeffery Flake[3]

[1]University of Wyoming, Research and Extension Center, 4516 US Highway 26/85 #2, Torrington, WY 82240. www.uwyo.edu/agexpstn/Station_Info/Torrington.htm
[2]University of Nebraska, Panhandle Research and Extension Center - 4502 Avenue I - Scottsbluff, NE 69361. www.panhandle.unl.edu
[3]Plant Sciences Dept., College of Agriculture - Department 3354,University of Wyoming,1000 E. University Ave., Laramie, WY 82071. www.uwyo.edu/plants

## Abstract

An assessment of the number and status of alternative crops that are under research and development by the Universities of Wyoming and Nebraska for southeastern Wyoming and the Nebraska Panhandle was undertaken. Thirty-six crops are identified for the region, which is characterized as having limited precipitation (370 to 420 mm/yr), and a short growing season (124 days). Most (21) are broadleaf crops. A similar number (22) are cool season prospects. Importantly, fifteen are alternative crops that producers should know how to grow, that have an established market, but that may not fit current economics. The remaining 21 crops require more research to further develop production packages and/or markets. The two universities are currently collaborating through their respective regional research and extension centers to help make this happen.

## Media summary

Universities in Nebraska and Wyoming are collaborating through their regional centers in the development of 36 alternative crops for the Nebraska Panhandle and southeastern Wyoming.

## Key Words

alternative crops, production package, market, economics.

## Introduction

*The Institutions*

Only 61 km separate the University of Wyoming Research and Extension Center at Torrington, WY from the University of Nebraska Panhandle Research and Extension Center at Scottsbluff, NE. This close proximity, and a shared mission to support the agriculture of the region through research and development, has led to numerous collaborations on the development of alternative crops for the region. Scientists at both locations have worked together, and closely with researchers from their parent institutions, and public and private research institutions from around the United States and the world, to develop viable cropping options for the region.

*Climate of the Nebraska Panhandle and Southeastern Wyoming region of the Central High Plains US (41-43?N; 103-105?W)*

Water is a major constraint. Long-term annual precipitation averages range from approximately 370 to 420 mm across the region, but much of the region has suffered from even less precipitation over the previous three years. Much of the crop land is fallowed every other year. Continuous cropping is limited to no-till production practices or irrigated production. Temperature is characterized by high diurnal variation, which can fluctuate as much as 28?C. Variation is frequently this large on a weekly basis. There is a short growing season, approximately May 25-Sept 25 (124 days) and hail during the summer months is a

hazard. The soils are shallow with limited water holding capacity. There is an overall east to west elevation gradient going from 1220 to 1830 meters. Slopes reduce soil water infiltration and stream flow irrigation and ground water reserves are limited.

*Current Significant Crops*

Predominant irrigated crops are alfalfa (*Medicago sativa*), sugarbeet (*Beta vulgaris*), corn (*Zea mays*), and dry bean (*Phaeolus vulgaris*). The predominant rain-fed crop is hard red winter wheat (*Triticum aestivum*). Next, at much lower production levels are proso millet (*Panicum miliaceum*), corn, and sunflower (*Helianthus annuus*).

*Climate Change*

Projections of climate change in the region include increased temperatures, mainly minimum temperatures, and increased precipitation in many areas. These changes have the possibility of affecting, either positively or negatively, many sectors, including agriculture, natural systems, and water. Diversification may be a key to coping with the potential climatic change (Wicks and Smika 1990, Baltensperger 1995, Ojima and Lackett 2002).

**Objective**

To report on the approaches and progress toward alternative crop development so agricultural producers can diversify now and in the future.

**Methods**

We have chosen to discuss alternative crops in terms of current markets and production knowledge as well as grouping crops by season. In terms of market and production knowledge there are three categories: Type I: Crops which producers know how to grow and have an established market, but may not fit current economics. Type II: Crops that are short of a production package or lack a market structure. Type III: Crops that are lacking both a market and a production package, but have potential for both.

Crops grouped by season are split into four categories. These categories are cool season grasses (CSG), cool season broadleaf crops (CSB), warm season grasses (WSG), and warm season broadleaf (WSB) alternatives.

**Results**

When added up, there are 36 crops that are at some stage of development as potential alternative crops for the region (Table 1). Fifteen of these are grasses. There are 21 cool season prospects under investigation. According to category there are 12 CSB, nine CSG, eight WSB, and seven WSG crops. Type I crops, the crops that producers know how to grow, have an established market, but may not fit current economics, number 15. We identified 14 as type II crops, which are short of a production package or lack a market structure. These are crops that are only recommended for on farm testing by producers. Finally, seven fall into the type III category as crops that are lacking both a market and a production package but have potential for both. With these we advise producers to follow the research and development activities with an eye on production in five to ten years.

**Table 1. Inventory of alternative crops in the Nebraska Panhandle and Southeastern Wyoming under research and development by the Universities of Nebraska (NE) and Wyoming (WY). Primary and secondary institution(s) are in capital and lower case letters, respectively.**

| Local name | Scientific name | Current markets and | Seasonal | Institution involved in |
|---|---|---|---|---|

| | | production knowledge | grouping | development |
|---|---|---|---|---|
| amaranth | *Amaranthus* spp. | Type I | WSB | NE |
| barley | *Hordeum vulgare* | Type I | CSG | NE ,WY |
| brassica, forage | *Brassica* spp. | Type I | CSB | WY, ne |
| brassica, SBN-resistant trap crop | *Brassica* spp. | Type I | CSB | WY |
| bentgrass seed | *Agrostis stolonifera* | Type II | CSG | NE, wy |
| bluegrass seed, Kentucky | *Poa pratensis* | Type I | CSG | NE, wy |
| canary grass seed | *Phalaris canariensis* | Type III | CSG | NE, wy |
| canola | *Brassica campestris & napus* | Type III | CSB | NE, WY |
| chicory, forage | *Cichorium intybus* | Type II | WSB | WY |
| chicory, sweetener | *Cichorium intybus* | Type I | WSB | NE |
| chickpea | *Cicer arietinum* | Type I | WSB | NE, WY |
| corn, rain-fed | *Zea mays* | Type I | WSG | NE , WY |
| crambe | *Crambe abyssinica* | Type III | CSB | NE |
| fescue seed, tall | *Festuca arundinacea* | Type II | CSG | NE |
| flax | *Linum usitatissimum* | Type III | CSB | NE |

| | | | | |
|---|---|---|---|---|
| lentil | *Lens culinaris* | Type III | CSB | WY, ne |
| lupin | *Lupinus* spp. | Type III | CSB | WY |
| medic | *Medicago rigidula* | Type II | CSB | WY |
| milkweed | *Asclepias syriaca* | Type II | WSB | NE |
| millet, foxtail | *Setaria italica* | Type I | WSG | NE, wy |
| millet, pearl | *Pennisetum americanum* | Type III | WSG | NE |
| millet, proso | *Panicum miliaceum* | Type I | WSG | NE, wy |
| mustard, brown | *Brassica juncea* | Type II | CSB | NE, wy |
| oat | *Avena sativa* | Type II | CSG | NE, WY |
| pea, Austrian winter | *Pisum arvenu* | Type I | CSB | WY |
| pea, forage | *Pisum arvense* | Type I | CSB | WY, NE |
| pea, grain | *Pisum arvense* | Type II | CSB | WY, NE |
| safflower | *Carthamus tinctorius* | Type II | WSB | NE |
| sorghum | *Sorghum biclor* | Type II | WSG | NE |
| sorghum/sudangrass | *S. biclor X sudanense* | Type I | WSG | NE, WY |
| sudangrass | *Sorghum sudanense* | Type II | WSG | NE, wy |
| sunflower | *Helianthus annuus* | Type I | WSB | NE, wy |

| | | | | |
|---|---|---|---|---|
| thistle, Niger | *Guizotia abyssinica* | Type II | WSB | NE |
| triticale | *X Triticosecale* | Type I | CSG | NE |
| wheat, hard white | *Triticum aestivum* | Type II | CSG | NE, WY |
| wheat, spring | *Triticum aestivum* | Type II | CSG | NE, WY |

Further considerations that could lead to additional narrowing of the potential choices are the potential effect of herbicide carryover from a previous crop and social issues. Agricultural producers within the region traditionally have concentrated on either crop production or ranching. Recently, there are indications that traditional crop producers, in response to low commodity prices and high cattle prices, are undertaking steps to integrate livestock into their operations. This could accelerate the adoption of some alternative crops.

**Conclusion**

Twenty-one of the 36 alternative crops (58%) require additional research and development to put them into the Type I category. Given the proper market conditions, they can truly become alternative crops for the region's producers. In light of predictions about climate change, it is important that we continue to investigate and develop these cropping options, and look for new ones. We believe that support from both the public and private sector for research and development is the best way to make this happen.

**References**

Baltensperger BH (1985). Nebraska.310, (Westview Press, Inc., Boulder, CO).

Ojima DS and JM Lackett (2002). In 'Preparing for a Changing Climate, the Potential Consequences of Climate Variability and Change – Central Great Plains'. i-iv, (NREL Ft. Collins, CO).

Wicks GA and DE Smika (1990). Central Great Plains In 'Systems of weed control in wheat in America'. (Ed. W.W. Donald) pp127-157.