Forage soybeans and blue Hopi flint corn as alternative crops on the Palouse

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Crop rotations on the Palouse are predominately comprised of cool season annual crops including wheat, pulses, and canola, which limits weed control strategies to pre-emergence herbicides or herbicides applied earlier in the growing season. Warm-season crops are planted later in the spring compared with cool season crops, so they offer differences in herbicide timing as well as mode of action. Furthermore, troublesome cool season weeds like winter annual grasses or broadleaf species can been controlled prior to planting warm season crops.

Climate patterns in the Palouse region have been less favorable to growing warm season crops common to the Midwest region because of diminishing rainfall through spring and summer; however, other options may be possible. We planted "Laredo" forage soybeans and blue Hopi flint corn on the Palouse Conservation Field Station near Pullman, WA (Figure 1). Forage soybeans are bred for leaf production instead of seed production and can be grazed or cut for silage or hay. Because they are bred for forage, they can be grown in drier areas and be harvested long before flowering. The Laredo cultivar is the oldest forage soybean that can tolerate a wide range of environmental conditions. Laredo is a bush-type soybean with small black seeds with a seed count of ~8,000 seeds/lb.

Blue Hopi corn originated with the Hopi people over centuries in northeast Arizona for its drought tolerance. It can be eaten fresh during the milk stage or used for hominy, grits, or cornmeal. It can also be used for livestock feed as green chop, silage, or corn grain. Blue Hopi corn is a ~110-115 day open pollinated flint type of corn that has blue pigment in the aleurone layer of the seed (Figure 2).

Figure 1. Blue Hopi flint corn (left) and Laredo forage soybeans (right) at the Palouse Conservation Field Station, Pullman, WA.

Laredo soybeans and blue Hopi corn were direct seeded 2 inches deep on May 15, 2025, with a Great Plains double disc drill. The soybeans were seeded at 48 lb/A in 10-inch rows. Seeding rate for the corn was 1 seed/ft of row with rows on 30-inch spacing yielding a density of 17,420 seeds/A. The soybean block was not fertilized but the corn block was broadcast fertilized after seeding with urea pellets at about 115 lb N/A.

For weed control, both blocks were sprayed with Roundup PowerMAX® (glyphosate) at 32 oz/A preplant to control established weeds. The soybean block was sprayed with Spartan® 4F (sulfentrazone) at 8 oz/A post-plant for preemergence weed control. On July 11, Butyrac® 200 (2,4-DB) was applied at 0.9 pt/A to control common lambsquarters, pigweed, and prickly lettuce. The corn block had no preplant or preemergence applications but was sprayed with Weedar® 64 2,4-D) at 1 pt/A on June 23 when the corn was about 12 inches high and still in the vegetative stage to control common lambsquarters, pigweed, and prickly lettuce. All applications were within label guidelines.

Laredo soybeans were sampled for biomass and nutrient composition on September 23 by collecting plants from six 1 m^2 areas across the block. At collection time the plants were beginning to flower. Plants were bagged and placed in a drying oven at 122 °F for four days until the bags had reached a consistent weight. Samples from each bag were collected and sent to Dairy One Forage Lab, Ithaca, NY, for nutrient analysis. Sampled biomass averaged 4520 lb/A (Table 1), which is comparable with first cutting alfalfa. Nutrient analysis indicated moderate forage quality as crude protein was only 9.4% and relative feed value was 124.5; however, total digestible nutrients was 63% and in the good range for alfalfa. These quality measures would likely have been higher if samples were collected earlier when the stems were less developed and also if there had been summer rainfall. From May through September, only 1.5 inches of rain fell, which was 3.7 inches below normal for the period. However, even with the drought conditions, nitrate accumulation in the plants was well within the safe zone (<1012 ppm). In other warm season crops like sorghum, drought or frost conditions can cause accumulation of prussic acid (cyanide), which is toxic in livestock. The benefit of feeding forage soybeans is that there is no risk of prussic acid; however, there is a slight risk of bloat in cattle similar to alfalfa if cattle are introduced too quickly to soybean forage, either fresh or hay. Planting forage soybeans with an annual grass such as oats can lower the risk of bloating. Furthermore, earlier grazing or haying can stimulate regrowth and would pair well with regrowth from an annual grass forage crop.

Figure 2. Blue Hopi flint corn.

Corn yield was assessed on October 7 by collecting all ears from four 30-ft lengths of rows. Parts of rows where the drill had not seeded evenly were excluded so yield would not be biased by planter issues. The ears (Figure 2) were shucked, bagged, and placed in a 122 °F drying oven for three days. Each ear was then shelled by hand and the kernels checked for moisture and weight. Yield was calculated on an acre basis with a standard moisture content of 15.5% and test weight of 56 lb/bu. Final yield was 89 lb/bu, or 5000 lb/A (Table 2), which was greater than yields from cool season spring crops in the area. In addition, several ears were collected from the field,

shucked and shelled, and the kernels ground to make cornbread, which was delicious! A concern for growing corn on the Palouse is getting ears dry enough for harvesting, therefore, shorter-season, drought-tolerant, and cold-tolerant cultivars may be needed. At the time of this picking, the black line at the tip of the kernel, which indicates full maturity, had not yet developed and the milk line on the kernels was still 3/4 to 7/8 down from the top of each kernel. Alternatively, high moisture (65%) corn plants with ears could be chopped for silage, or just the ears picked later when drier (20%) and put into corn cribs for shelling at a later date.

Warm season crops can be successful if cultivars are adapted for regional climate conditions. Yields of both the forage soybeans and the corn were relatively outstanding given the drought conditions through this summer. Weed control was very effective with the strategies employed; however, the drought conditions may have aided weed control by not causing later flushes. Warm season crops add both new and challenging options and may be useful when confronting herbicide resistance in traditional crops grown in the area.

Table 1. Nutrient analysis on average of forage soybeans sampled September 23, 2025, grown at the Palouse Conservation Field Station – Pullman, WA.

Nutrient	Concentration	Value**
Biomass*	lb/A	4,520
Crude protein (CP)	%	9.4
Water soluble carbohydrates (WSC)	%	11.2
Total digestible nutrients (TDN)	%	63.0
Net energy - gain (NEg)	Mcal/lb	0.35
Relative feed value (RFV)	N/A	124.5
Calcium (Ca)	%	1.1
Phosphorus (P)	%	0.2
Nitrate-N (NO_3)	ppm	146.0

*Biomass listed as oven-dried weight after reaching a constant weight, all other nutrients listed on dry matter basis.
**Values are averages of six 1 m^2 samples per nutrient, except for nitrates which is the average of two samples.

Table 2. Yield components on average of Hopi blue flint corn grown in 2025 at the Palouse Conservation Field Station - Pullman, WA.

Component*	Measurement	Value
Yield	lb/A	5000
Yield	bu/A	89
Ears	#/ft of row	1.1
Kernels	lb/ear	0.26

*Yield calculated on a 15.5% moisture basis and 56 lb/bu test weight.