



# Production and Management of Old World Bluestems

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Old World bluestems were introduced from Europe and Asia from 1920-1965. These grasses have been studied extensively in Oklahoma in the last 50 years, but producer interest was not widespread until recently.

Old World bluestems are warm-season bunchgrasses that possess good forage potential for the southern Great Plains. These grasses respond well to fertilization, are drought and cold tolerant for the most part, withstand close grazing and are palatable to cattle. Old World bluestems are not closely related to the native big and little bluestem grasses found throughout Oklahoma.

The six most common cultivars for use in Oklahoma include: 'Caucasian,' 'Ganada,' 'King Ranch,' 'Plains,' 'WW-Spar' and 'WW-Iron Master,' 'Caucasian' and 'King Ranch' have been commercially available for more than 30 years, whereas 'Plains,' 'Ganada,' 'WW-Spar' and 'Iron Master' are more recent releases. The newest Old World bluestem cultivar is 'WW-B.Dahl.' A comparison of the different cultivars is found in Table 1.

## Stand Establishment

Old World bluestems are best adapted to loam or clay-loam soils. Stand establishment on sandy or sandy-loam soils may take a season longer to establish and become productive, but with management, a solid stand can be obtained. Soil test for nitrogen (N), phosphorus (P), potassium (K) and pH should be collected well in advance of establishment. Lime must be applied according to soil test recommendation and incorporated within the seedbed. Depending upon rainfall, it will take 120 to 270 days for the lime to completely react

and fully change the soil pH. Seeding should take place in a firm seedbed either by broadcasting the seed or planting it at shallow depths (1/4 inch or less). Seeding rates of 1 to 3 pounds pure live seed per acre are generally recommended. The best results have been obtained when seeding was done with a drill specifically designed to handle "fluffy" grass seeds. These drills contain paddles or fingers that improves the seed flow into the seed tube openings. An option is to purchase debarbed seed, which facilitates seed flow (Figure 1). Old World bluestem seeding can begin immediately after the last killing freeze date to about June 15. However, seeding after June 1 increases the risk germination and early establishment during the onset of hot and dry weather. At this point, irrigation would be necessary for fast and uniform emergence. Seedlings will start to emerge when the soil temperature is consistently at or above 60 F; therefore the best timing to plant Old World bluestems is from late March to April 15.

No-till establishment is an option to reduce soil, water erosion and control water evaporation in arid locations. However, no-till planting has some restrictions: 1. Too much residue can suppress Old World bluestem emergence, 2. Sorghum and small grains (wheat, rye, barley and oats) residues are allelopathic to Old World bluestem. Furthermore, the area should be treated with herbicides to control weeds prior to planting. The no-till planter must place the seed into a furrow at a depth of 1/2 inch, then press wheels must firm the furrow to ensure good seed soil contact. Seeds lying on the residue are unlikely to establish.

**Table 1. Characteristics of different Old World Bluestems.**

<i>Name</i>	<i>Origin</i>	<i>Area of Adaption</i>	<i>Remarks</i>
WW-B.Dahl	India	West of I-35, South of I-40	Late maturity, not as cold tolerant
Caucasian	Russia	Statewide	Most productive, winter hardy, slightly less palatable
Ganada	Russia	Western 1/3, high plains	Good drought tolerance, good forage quality
King Ranch	China	Extreme southern counties	Most palatable, but easily winter killed and susceptible to rust
Plains	Asia	Statewide	Most popular, very adaptable, longer grazing season
WW-Spar	Pakistan	Statewide	Winter hardy, most drought tolerant
WW-Iron Master	Afghanistan	Western 1/3 high plains	Better adapted to soils with iron deficiency



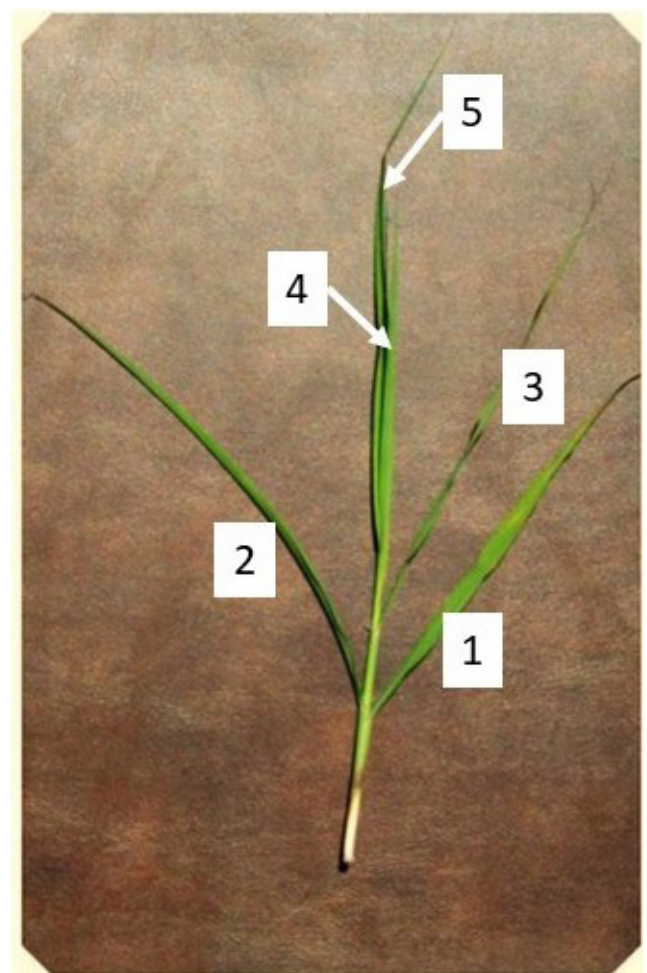
**Figure 1. Old World Bluestem seeds. Bearded seed (left) and debarbed seed (right).** Photo courtesy: Dr. Charles P. West, Texas Tech University.

The traditional approach to fertilization is to broadcast recommended P, K and lime, incorporating them during seedbed preparation, then apply N after the seedlings have reached the 4- to 5-leaf stage (Figure 2). This method works; however banding a nitrogen-phosphorus fertilizer in a row near to the seed has shown better results, and can be done in no-till systems. Use 18-46-0 (DAP), 11-52-0 (MAP), 10-34-0 (liquid) or any other N-P-K grades to band in rows 14 inches or narrower, no more than 20 pounds of actual N and K<sub>2</sub>O per acre. Higher rates will increase the risk of seedling salt injury. See the E-1039, *Oklahoma Soil Fertility Handbook* Chapter 5 for a more in-depth discussion on in-furrow banding of fertilizers. If using DAP or MAP, 50 to 100 pounds of phosphate would need to be applied per acre. Use the soil test analysis to determine the rate of P needed. If more is needed than can be applied in-furrow, broadcast and incorporate the remaining portion during seedbed preparation. Potash (K) can be incorporated during seedbed preparation or broadcast after stand establishment.

The first year of establishment will likely have high weed densities. After seeding, early summer annual weeds will grow quicker than the seedlings, out competing for light, water and nutrients. Light grazing or mowing of weeds are the best options during the first weeks after planting. Selective herbicides can be used after Old World bluestem reaches the 4- to 5-leaf stage. Most herbicide applications prior to this stage may affect seedling development. Always consult herbicide labels for proper application. Contact the local county Extension educator with any questions related to herbicide application. The nearest county Extension office can be located at: <http://countyext2.okstate.edu/front-page#D>

### Growing Season in Established Years

Old World bluestems typically begin growth in late April. As with other warm-season grasses, most of the forage production from Old World bluestems occurs by mid-July (Figure 1). However, these introduced bluestems are more responsive to



**Figure 2. Old World bluestem at 4- to 5-leaf stage.**

late summer and fall precipitation than are the native grasses. As such, substantial regrowth can occur in August and September when moisture is available. In general, Caucasian and WW-Spar attain peak production and maturity earlier in the summer (mid-July) than does Plains. Plains is a mixture of 30 different varieties each maturing at slightly different times, thus a longer green grazing season. WW-B.Dahl (Figure 3) is the cultivar with the latest maturity attaining peak production and maturity a month later (mid-August) than Caucasian and WW-Spar.

### Forage Yields and Nitrogen Fertilization

Forage yields from Old World bluestems will range from 1 to 5 tons per acre on dryland sites depending on the cultivar, fertility program, soil type, and growing conditions. Generally, 2 to 3 tons per acre of forage can be expected in most years. Several studies have shown Caucasian to be the most productive cultivar, usually producing 10 percent to 20 percent more forage than other cultivars under favorable soil moisture conditions (Table 2). Yields of Plains, Ganada and WW-Spar tend to be similar, but greater than King Ranch. WW-Iron Master will produce fewer seed heads and stems than WW-Spar or Plains, so seed production will be less and the price will be higher.

Old World bluestems respond very favorably to nitrogen fertilization. Studies show that 20 to 50 pounds of additional forage will be produced for each pound of actual nitrogen added. A single application of 60 pounds of nitrogen per acre in April is as effective, or in some years more effective, than split applications (Table 3). Higher rates of nitrogen are appropriate in eastern Oklahoma and on irrigated sites where yields may achieve 8 tons per acre. Generally, fertilizer should not be added after September 1, as this can result in excess growth just prior to a killing frost, which may contribute to plant kill during winter. In addition to improving forage yields, nitrogen fertilization will also improve crude protein content of the forage by 2 to 5 percentage points.

**Table 2. Forage yields (pounds/acre/year of dry matter) from Old World Bluestems.**

Location	Dates	Cultivar	Yield	% of Plains
Ardmore	2004-05	WW-B.Dahl	8,500	152
		Plains	5,600	100
Ardmore	1980-83	Caucasian	8,000	134
		Ganada	6,100	103
		Plains	6,000	100
		WW-Spar	5,100	86
Mangum	1969-70	Plains	4,100	100
		King Ranch	2,700	66
Perkins	1969-71	Caucasian	12,200	120
		King Ranch	6,600	65
		Plains	10,200	100
Woodward	1979-81	Caucasian	7,900	136
		Plains	5,800	100
		WW-Spar	6,900	119

**Table 3. Applied nitrogen fertilizer recovered as plant-N from Old World Bluestem forage over five harvest seasons as affected by N fertilization rates on Woodward sandy loam.**

Year	<i>N Applied lbs/ac/yr</i>				
	0	30	60	60(split)	90
<i>lbs N/acre recovered</i>					
1982	13	31	49	45	67
1983	4	18	31	22	27
1984	4	18	22	13	27
1985	9	22	40	40	58
1986	4	9	22	18	22
Ave. Recov. %	—	19	33	28	40

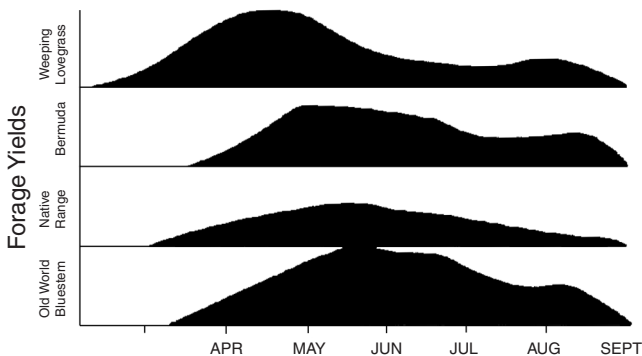
Berg, W.A., J. Range Mngt. 43:265-270



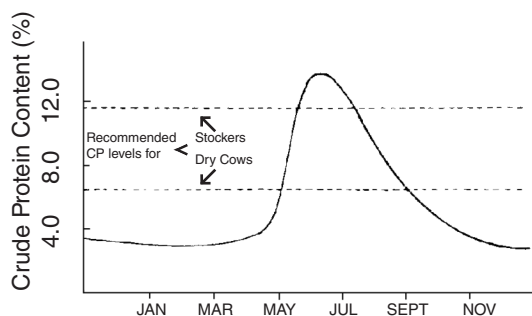
**Figure 3. WW-B.Dahl Old world bluestem on July 10th (left) and on Sept 8 (right) near Lubbock, TX. Photo courtesy: Dr. Charles P. West, Texas Tech. University.**

## Forage Quality and Palatability

Several factors influence forage quality, including stage of growth, species of grass, and soil fertility. All warm-season grasses, including Old World bluestems, are highest in forage quality (crude protein and digestibility) in early summer (May-June) when new plant growth is most available. After mid-July, most warm-season grass forage quality declines rapidly until fall, after which time forage quality remains rather constant (Figure 4). Differently, Old World bluestems offer higher quality forage during late-summer (July to August) than grasses like Bermudagrass, weeping lovegrass or tallgrass native range (Big bluestem, Switchgrass, Indiangrass and Little bluestem). Old World bluestem is similar in quality during late summer to short and midgrass native range, (buffalograss, blue gama and sideoats grama). Limited grazing trials with stocker cattle at Haskell suggests that gains from July through August were higher on Plains than 'Midland' Bermudagrass at similar fertility levels. Studies at Woodward indicate that steer gains from Old World bluestems were higher in late-summer than from either native range or weeping lovegrass. Generally, forage from Old World bluestems meets or exceeds recommended requirements for animal growth from May to July 15, but additional protein supplementation may be necessary during other periods, especially with stocker animals (Figure 5). However, Old World bluestem fall forage quality are superior



**Figure 4. Generalized seasonal forage production of four warm-season grasses.**



**Figure 5. Seasonal crude protein content of Old World Bluestems.**

than equal or inferior short and mid-grass native range. Fall Studies at the Marvin Klemme Research Range near Cordell indicate short and mid-grass native range equals or exceeds Old World bluestem forage quality from September through the fall. Native range was preferred for wintering cattle.

All of the commercially available Old World bluestems are similar in forage quality. Digestibility typically ranges from 50 percent to 60 percent and crude protein content varies from 4 percent to 13 percent, depending primarily on the stage of growth of the grass. Studies have shown that Caucasian may be slightly less digestible (1 to 3 percentage points lower) than Plains or WW-Spar, however the additional forage yields obtained from Caucasian probably offset such minor difference in forage quality.

## Hay production and Value

Limited studies have been conducted on the value of Old World bluestem hay. These studies indicated that, when properly fertilized and harvested right before heading, high yields of good quality hay (10 percent to 16 percent crude protein) can be obtained. Caucasian, WW-Spar and Plains Old World bluestem stands have produced as much as 3 to 4 tons of hay per acre with an in-vitro dry matter digestibility of 57, 61 and 60 percent, respectively. Steers fed good quality Caucasian Old World bluestem hay, supplemented with adequate protein, gained over 2.2 pounds per day during winter feeding trials. WW-Spar Old World bluestem hay, harvested after producing a summer seed crop, produced gains of 1.44 pounds per head per day in the same study. It is advised to maintain a minimum of 3-inch stubble height during cutting to ensure proper regrowth. Two cuts are expected per growing season.

## Grazing Management

The proper animal stocking rate in a pasture depends upon (a) the amount and quality of forage produced and (b) how efficiently the animals harvest the forage. As discussed previously, Old World bluestems can produce large amounts of forage when moisture and fertility requirements are met. Proper grazing management is necessary, however, to maximize the conversion of grass to beef.

Continuous grazing offers good animal performance but tends to promote uneven (spot) grazing. Rotational grazing promotes better grazing distribution and forage utilization. Also, by providing alternating periods of grazing and rest, rotational grazing increases plant vigor, and subsequently higher forage production. As a result, beef gains per acre can be increased 10 to 25 percent by using some form of rotational grazing plan.

Rotational grazing involves subdividing a large pasture into smaller pastures called paddocks. This is done most economically with electric fencing. The number of paddocks will vary, but most systems use three to six paddocks. Livestock are rotated throughout the paddocks as forage conditions dictate. Generally, when forage growth is rapid, movement is rapid (every five to ten days), whereas when forage growth is slow, as during a drought, the speed of rotation is slower (every three to five weeks). This type of grazing maintains the grass at a higher growth rate and better forage quality than if grazed continuously. Grazing should begin when grass reaches 12 to 18 inches in height and continue until the grass is grazed down to a 3- to 4-inch stubble height. Livestock are

then rotated into the next pasture, and so on. The system should be designed so animals will return to the first paddock in four to six weeks. Flexibility is critical in a rotational system. Livestock moves should be based on forage availability and maturity, not by a set number of days. After six to eight weeks of growth, forage becomes mature and loses quality rapidly. If forage growth is too fast to keep pace with grazing, then that paddock should be harvested for hay.

## Beef Production

Stocker gains on Old World bluestems range from 1 to 2 pounds per day during summer and from 0.1 to 0.5 pounds per day during winter (Table 4). Stocker gains can exceed 2 pounds per day from early May to mid-July when forage quality is highest, but gains tend to drop off during late summer unless additional protein supplementation is available. Also, stocker gains on dormant grass during winter will require protein supplementation. Because cows have lower protein requirements than stockers, Old World bluestems can provide most of the necessary nutrients for a longer period of time for cows than for stockers. However, additional protein will still be necessary during winter and possibly other times, depending on the physiological condition of the cow (i.e., lactating, late pregnancy, etc.)

**Table 4. Gains of yearling steers grazing 'Caucasian' and 'Plains' bluestem between 1977 and 1983 and 'WW-Spar' bluestem between 1981 and 1983 at the Southern Plains Experimental Range.<sup>1</sup>**

Item	Cultivar		
	Caucasian	Plains	WW-Spar
Average daily gain (lbs/hd/day)			
Winter	0.38	0.40	0.52
Summer	1.73	1.66	1.46
Gain/Steer (lbs/season)			
Winter	42	41	46
Summer	238	241	220
Year	280	282	266
Gain/acre	198	200	177

<sup>1</sup> The summers of 1982 and 1983 were dry, resulting in lower gains. Gains from all varieties were similar during these dry summers.

**Table 5. Stocking rates - Old World Bluestems.**

	Forage Production (lbs/acre)		
	3,000	5,000	7,000
Acres/Steer <sup>1,2</sup>			
yearlong	2.9	1.7	1.2
May - Sept.	1.1	0.6	0.4
Acres/Cow <sup>3</sup>	4.8	2.9	2.0

<sup>1</sup> Assumes 70% utilization.

<sup>2</sup> Steer consumes 15 pounds dry matter per day.

<sup>3</sup> Cow consumes 25 pounds dry matter per day.

Cattle gains from Old World Bluestem on old cropland sites are often higher than gains from upland native range sites because of differences in soils and the addition of purchased fertilizer. Stocking rates on Old World bluestem will vary from one steer per 3 acres for the growing season in western Oklahoma to about one steer per acre in central and eastern Oklahoma. At these stocking rates, beef production can reach 200 pounds per acre on cropland sites with good fertility and moisture (Table 4.)

Stocking rates should be based on forage availability (Table 5). Stocking rates will vary from year to year, depending on rainfall. Stocking rates can be increased by 10 percent to 25 percent by using rotational grazing as opposed to continuous, season-long grazing.

## Forage Systems

Forage systems incorporate forages that complement each other to allow for maximum beef production from an area. Different forages are selected based on their growing season, production characteristics, and seasonal forage quality. Old World bluestems have good potential as a component of forage systems for the southern Great Plains. In western Oklahoma, forage systems may utilize such forages as native range, Weeping lovegrass, Forage Sorghums, Alfalfa, Bermudagrass and small grain pastures in addition to Old World bluestems. For eastern Oklahoma, these forages, plus others like annual and perennial Clovers and Tall Fescue, should be considered. Consult the local county Extension office or Soil Conservation Service office for advice on planning the forage system best suited to your operation.

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