Crop Profile for Cotton in Kansas

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General Production Information

Although Kansas ranked 18 in cotton production and contributed only 0.4% to U.S. production in 2002, cotton is becoming a popular alternative to traditional crops in Kansas. Kansas planted and harvested acres increased in 2002 with 80,000 acres planted, up 39,500 acres from 2001. Kansas produced 76,000 bales, up 60% from 2001. The 60,000 harvested acres were up 24,500 from 2001. The average yield in 2002 was 608 lbs. The average cost of production for cotton in Kansas is about $200 per acre.

Production Regions

In 2002, the southwest district led the state in cotton production with 34,300 bales. This district has 55% of the planted acres and accounted for 45% of the total Kansas cotton production. The south central and southeast districts produced 30,600 and 10,600 bales respectively, while the remaining districts produced 800 bales.

In Kansas, most cotton was produced under dry-land conditions as in Cowley, Montgomery and Labette counties in the southeast district, and Sumner, Harper, Barber, Sedgwick, Kingman, Pratt and Harvey counties in the south central district. Nearly all of irrigated cotton was planted in Harvey and Pratt counties in the south central district, although substantial acreage is planned for Stevens county and surrounding counties in the southwest district.

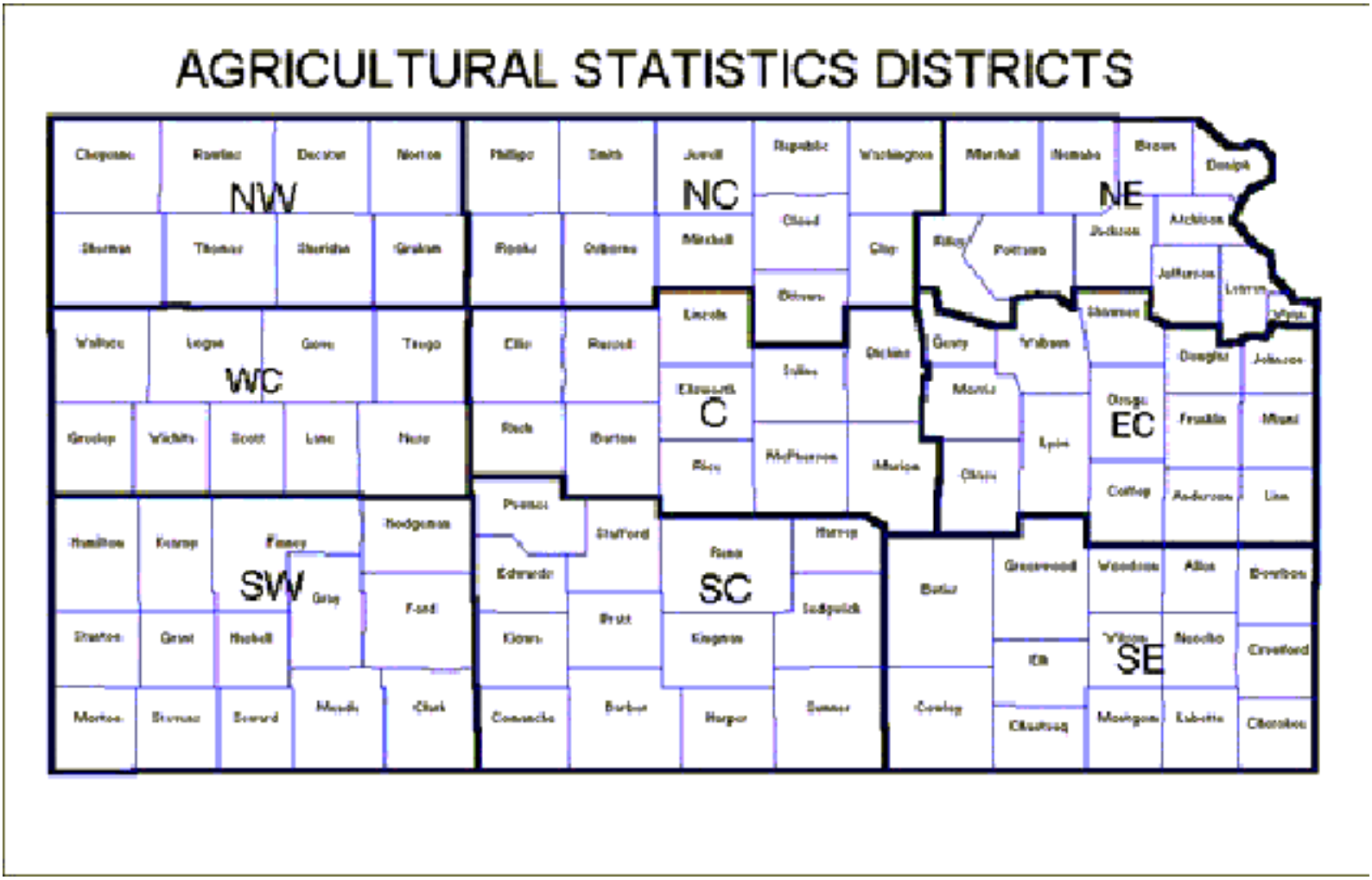

Figure 1

Cultural Practices

Kansas is divided into nine districts (Figure 1). The areas considered to be best to support profitable cotton yields are those southern districts in Figure 1. Soil types vary within a district. In general, soils in the southwest counties are silt and sandy loams, and brown loamy fine sands. Moderately deep, dark gray-brown silt-loam soils, and gray clays dominate the central district of Kansas. Shallow, very dark gray-brown silt, clay, and silty clay loam soils are predominant in southeastern Kansas. Average rainfall ranges from 16-18 inches in the western half of Cheyenne, Sherman, and Wallace counties in the northwest to 42-44 inches in the eastern half of Crawford and Cherokee counties in the southeast region.

Cotton is a minor crop in Kansas, although it is considered an alternative crop to traditional crops, especially in the southern tiers of counties. Most of the cotton varieties grown in Kansas are upland cotton and used as a source of fiber for denim. In addition, cotton is grown as a source of vegetable and industrial oil. Crushed and whole seeds are used as a high source of protein in animal feed. Cotton is grown on various types of soils, but friable soil with good humus supply and favorable moisture holding capacity are best for cotton growth and development. Silt loam, loam, fine sandy loam, and well-granulated clay loam soils are best. Ideally, cotton is planted between May 1st to June 1st, but it can be planted as late as June 15th with variable results. For optimum cotton seed germination, soil temperature at 7.5-8 inches deep should average 60-63 ^{o}F for 3 days

before planting, and air temperatures should average 70°F for 3-5 days after planting with no rain. The cotton seedbed should be firm, and the surface should be dry. The acid-delinted seed should be placed 1 to 1.5 inches deep, depending on soil type and moisture conditions, in tilled or no-tilled fields. Besides delinting, cotton seed is treated with fungicide(s) and/or insecticide before planting. Desired plant populations range from 50-60K plants per acre for dryland fields and 75-90K plants per acre under irrigated conditions when cotton is planted in 30-inch row spacing. However, cotton has the ability to compensate for reduced stands (down to 17,500 plants per acre) and still produce profitable lint yields. Ideally, cotton in Kansas is harvested from early to mid October. Stripper machines are used to harvest the short growing season varieties in Kansas by pulling the entire cotton boll from the stalk. In regions with a short growing season, harvest aids such as desiccants and defoliants are commonly recommended and used prior to harvest. Desiccants are applied to aid in strip harvesting by causing plants to quickly lose water and promote plant dryness.

On year 2002 survey, we did not collect information on worker activities (e. g., hand weeding, pruning, thinning, spot-treating, mowing, hand-harvesting, and hand pollination) involved in growing this crop.

Pesticide Usage on Cotton for Year 2002

The Kansas pesticide usage survey on cotton for Year 2002 was conducted by the Kansas Agricultural Statistics Service (KASS) and Kansas State University from October to December 2002. Since cotton is one of the relatively smaller crops in Kansas, questionnaires were mailed directly to all growers for commodity cotton (who were identified by KASS based on year 2001 survey). In total, 223 questionnaires were sent out and 120 of them were collected with valid data from 6 regions and 32 counties. The following table displays the sample distributions in terms of regions (districts) and counties in Kansas.

Sampling Data Distribution

Regions	County	Survey	Sample(%)
30 (SW)	5	13	10.83
40 (NC)	1	1	0.83
50 (C)	3	4	3.33
60 SC)	10	64	53.33
80 (EC)	4	4	3.33
90 (SE)	9	34	28.33
sum	32	120	100.00

Southwest, south central, and southeast were the major contributors to cotton production in Kansas in 2002. Approximately 93% of data were also collected from those areas. Approximately 50.4% of the pesticides used were applied directly by farmers/growers/rancher-self against various pests and 49.6% of the pesticides were applied by commercial entities.

Insect Pests

Few Kansas producers have yet to encounter severe insect damage, but due to the increase in cotton acreage every year, yield losses to insects can be expected to increase. Kansas growers escape most of the damaging insect pests in the cotton belt. Cotton boll weevil, which is identified as a primary insect pest in the cotton producing states, likely will not survive Kansas winter conditions. However, problems from the following insects have been experienced in Kansas:

Cotton Bollworm (*Helicoverpa zea*) is not only a major pest of cotton, but other crops such as corn and sorghum (referred to as corn earworm and sorghum headworm) as well. Bollworm is found in every cotton field in the cotton states. It can attack cotton at any time. The larvae grow up to 1.5 inches in length. Their color varies from light green, pink, brown or black on the upper body surface and is lighter on the underside with stripes running the length of the body. The moth has a wingspan of 1.5 inches. The moths lay eggs in the spring, mainly on the edges of leaves and also on the stems, bracts, blooms, squares, and bolls. Scouting frequently is necessary to decide on a management practice. Mature larvae drop to the soil and pupate burrowing into the soil 10-12 days before the moth emerges. In Kansas there are typically three to four generations on cotton.


Bollworms damage cotton by feeding on tender leaves and other vegetative parts before attacking fruiting forms. Feeding on, or cutting off, terminals delays maturity. Larvae tunnel into small squares and terminal buds leaving various sizes of holes. Feeding damages or destroys the squares, blooms and bolls causing squares to drop from the plants. (Image source = http://creatures.ifas.ufl.edu/veg/corn_earworm06.htm).

Naturally, many predators and parasites combine to substantially maintain cotton bollworm populations at low levels. However, insecticide sprays for other pests will disrupt this natural control and may result in severe outbreaks of this pest. Cotton bollworms are attracted to succulent, rank-growing cotton plants; maintain water, fertilizer, and plant density at recommended levels to avoid rank growth. Because populations seldom reach damaging levels before late summer, manage the crop for early maturing. The following pesticide products have been recommended for control of this pest (http://www.ipm.ucdavis.edu/PMG/r114300511.html):

A. BACILLUS THURINGIENSIS (various products)
B. METHAMIDOPHOS (Monitor 4EC)
C. METHOMYL (Lannate LV, Lannate SP)

 **Cotton Fleahopper (*Pseudatomoscelis seriatus*)** adults are yellow-green, white or yellow with an elongated, oval outline and prominent antennae. Eggs are deposited under the bark of small stems. The young nymphs feed on tender vegetation. Within 14 to 15 days, nymphs mature to adult stage. Adult fleahoppers migrate from host weeds when cotton begins to square. They feed on anthers of small squares and suck sap from leaf buds causing squares to turn brown. Heavy infestations cause significant fruit loss. No specific pesticides for fleahopper control in cotton have been recommended for Kansas. (Image source = http://www.gaipm.org/top50/fleahoppers.html).

 **Thrips** There are many different species of thrips. The western flower thrips (*Frankliniella occidentalis*) and tobacco thrips (*F. fusca*) are known to feed on cotton seedling. Adults are tiny (less than 2 mm), yellow, brown, or black in color. Most adults have two pairs of narrow wings fringed with long hairs. The larvae are 0.25 mm long, wingless, and white or yellow in color. Cool, wet conditions favor thrips infestations that delay fruiting and plant maturity. The insect rasps and sucks plant saps from the leaves in the buds causing them to curl upwards, edges turn brown. Infested plants become stunted and new growth is retarded. Under severe infestation, plants may even die. Early planting may escape thrips infestations and plants recover and suffer no yield loss. Insecticides are either applied as seed or seed box treatments, or a granular systemic insecticide is used at planting. (Western flower thrip, image source = http://www.gaipm.org/top50/thrips.html).


Cutworms have been reported occasionally on cotton. Cutworms are sporadic pests, typically causing economic injury to a small percentage of cotton fields each year. However, severe infestations can reduce stands to the extent that replanting is necessary. Only the larval stage is damaging and is almost always found hidden below ground during the day. Larvae "cut" the stems of seedling cotton plants. Occasionally smaller larvae may feed on leaves without cutting plants. No specific pesticide for variegated cutworm control in cotton has been recommended for Kansas. (Image source = http://www.ipm.ucdavis.edu/PMG/r114301911.html#DAMAGE (left); http://www.aces.edu/department/ipm/cip15f2.htm (right, larvae on seedlings)).

During 2002, 47% of the total cotton was treated with various insecticides. At least four different insecticides (ingredients) were used in the control of four major insect pests on cotton. The following table lists the insecticides used and major insect pests controlled on cotton.

Insecticides and Targeted Insect Pests

Insecticide (Ingredients)	Insect Pest Targeted
Acephate	Cotton Fleahopper, Thrips, Other
Aldicarb	Thrips
Dimethoate	Bollworm, Thrips
Phorate	Thrips

The following table displays the insecticide trade names, modes of actions, acres treated, percentage of area treated, and application rate.

Insecticide Usage Survey on Cotton

Insecticide (Ingredient)	Trade name	Mode of Action[b]	Acres Treated	Percent Treated*	Rate (lb a. i./a)
Acephate	Orthene	CI	5602	69.81	0.14
Aldicarb	Timek	CI	770	9.60	0.46
Dimethoate	Dimethoate	CI	900	11.21	0.08**
Phorate	Thimet 15G, 20G	CI	753	9.38	0.04

*: Percent Treated = (acreage treated with a given insecticide / the total acreage treated (8025 acres)) * 100.
**: The amount may be less than recommended due to the small sample size.
[b]: CI = Cholinesterase inhibitor.

Acephate is the most frequently applied insecticide among insecticides used against various insect pests on cotton in Kansas, up to 69% of the sampled treated areas did so at a rate of 0.14lb/a, followed by dimethoate at a rate of 0.08 lb/a.

Diseases

Although losses from diseases have not been reported in Kansas to date, Verticillium wilt, Fusarium wilt, bacterial blight, seedling diseases and boll rot can reduce cotton yield. Seed and seedling diseases are important both in fields previously planted to cotton and fields with no history of cotton. Due to its recent introduction and relatively small acreage in Kansas, diseases losses have not yet been reported. However, as acreage increases and fields develop a history of cotton production, the potential for disease damage will increase.

Seed and seedling diseases are caused by several soil- or seed-borne pathogens. Known pathogens include *Rhizoctonia* spp., *Pythium* spp., and *Fusarium* spp. Symptoms of seedling diseases include soft watery rot of the seed and young roots and damping-off of the hypocotyl at or below the soil line. Lesions may also occur on the cotyledons, hypocotyl and stems. Damaged seedlings that emerge are pale, stunted, slower growing, and sometimes die within a few days. Seedling disease occurs more frequently under cool, wet conditions and seems to be more prevalent on sandy, low-organic-matter soils. Environmental factors are very important in influencing the development of seedling diseases. Learn more about cotton seed and seedling diseases please refer to following link: http://www.ces.ncsu.edu/depts/pp/notes/Cotton/cdin1/cdin1.htm. (Image source = http://www.ces.ncsu.edu/depts/pp/notes/Cotton/cdin1/cdin1.htm).

Bacterial blight is caused by *Xanthomonas campestris* pv. *malvacearum*. This bacterium survives in seed, on seed lint and in infested plant residues. Initially, green, round to elongate, water-soaked spots appear on leaves. Eventually, lesions become angular or irregular-shaped. The spots are brown to black in color and are found between veins and along the main leaf veins and petioles. Diseased areas dry up quickly, become sunken, and are reddish brown. Leaf defoliation may occur. Under severe infection, lesions may form on the boll as well.). As disease progresses, leaf petioles and stems may become infected resulting in premature defoliation. Learn more about cotton bacterial blight please refer to following link: http://www.ces.ncsu.edu/depts/pp/notes/Cotton/cdin3/cdin3.htm. (Image source = http://www.ces.ncsu.edu/depts/pp/notes/Cotton/cdin3/cdin3.htm).

 **Phymatotrichum or cotton root rot** is caused by *Phymatotrichum omnivora*, a fungus that thrives in warm and moist conditions in early summer. The fungus attacks the roots causing extensive decay of the root bark and the lower stem bark. Infections by *Phymatotrichum* cause rapid wilting, yellowing of the leaves, and death of plants.
The fungus is capable of persisting for a long period of time in the soil. The fungus survives almost indefinitely in the soil sclerotia. The fungus enters the roots of infected plants, decaying the bark and penetrating the woody portions of the root. Nutrients derived from infected plants support the growth of the fungus through the soil to infect new plants. Learn more about cotton bacterial blight please refer to following link: http://pearl.agcomm.okstate.edu/plantdiseases/f-7621.pdf. (Image source = http://cipm.ncsu.edu/cottonpickin/disorders/group.cfm?key=2&grup=Fungi).
Even though the plant diseases mentioned above may impact cotton growth and development, there was no report of fungicide usage in cotton production based on the Year 2002 survey.

Weeds

Annual Grasses

 **Barnyardgrass** (*Echinochloa crusgalli* L.) **(cockspur, watergrass)** is originally from Europe. It is an annual growing to 1.5 meters tall; stems usually flattened in cross-section at the base; smooth leaves often purplish at the base; flowers covered with short, stiff hairs. It can produce over 1 million seeds. Seeds are the only source of reproduction. It flourishes in warm conditions. It is common particularly in moist areas high in fertility, such as irrigated fields and old feedlots and it can become a problem weed in no-till situations. This weed alone could remove as much as 80% of nitrogen from the soil. Refer to following link to learn more about this weed: http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=ECCR. (*Echinochloa crusgalli*, image source = http://www.mta.ca/~rthompso/nativeflora/group12/Page52.html#photo).

Large crabgrass (*Digitaria sanguinalis*) (**hairy crabgrass**, **purple crabgrass**) is a warm season grass. It is a **summer annual having a prostrate or ascending growth habit with stems that root at the nodes. Blades 1.25 to 8 inches long, 3 to 10 mm wide, with hairs on both surfaces. Leaves and sheaths may turn dark red or maroon with age. Seed head composed of 4-6 branches (spikes) at the top of stems.** Seeds are the only source of reproduction. Found in cultivated fields, gardens, roadsides, pastures, and waste places. Learn more about this weed please refer to following link: http://www.ppws.vt.edu/scott/weed_id/digsa.htm. (*Digitaria sanguinalis*, image source = http://www.hortpix.com/pc1484.htm)


Fall panicum (*Panicum dichotomiflorum***)** is a native weed. It is a summer annual with large round, smooth sheaths that are often bent at the nodes. This weed may reach 7 feet in height and is found throughout most of the United States in various agronomic and horticultural crops. A key identifying characteristic of this weed is the 'zigzagged' growth pattern due to bending at the nodes. Leaves are rolled in the shoot. Seeds are the only source of reproduction. It flourishes in warm conditions. Common in cropland, waste areas, roadsides, overgrazed pastures, and disturbed areas. Learn more about this weed please refer to following link: http://www.ppws.vt.edu/scott/weed_id/setfa.htm. (*Pancium dichotomiflorum*, image source = http://www.inhs.uiuc.edu:3333/cwe/illinois_plants/ThePlants/PGenera/PanDic/PanDic.html).


Foxtails, including giant (*Setaria faberi*) (**giant bristlegrass, Chinese foxtail, Chinese millet, nodding foxtail)** native of Asia; green (*Setaria viridis* L.) **(green bristlegrass, pigeongrass, wild millet)** native of Eurasia**; and yellow** (*Setaria glauca* L.*)* **(yellow bristlegrass, pigeongrass, wild millet)** native of Europe. Seeds are the only source of reproduction. It is common on cultivated grounds, waste places, roadsides, and degraded rangeland and pastures. Foxtails are summer annual grasses and are common in Kansas. Mature foxtail plants are 1 to 3 feet tall, with branching and some spreading at their bases. Leaf blades are 4 to 15 inches long, and most have a spiral twist. Flower heads are dense spikes with yellow to reddish bristles or green to purplish bristles, depending on species. (*Setaria faberi*, image source = http://dogwood.botany.uga.edu/herbarium/herbarium/gaflowers/setaria_faberi.htm).

Annual Broadleaf Weeds

Common cocklebur (*Xanthium strumarium*) is a native weed. It is **a summer annual that produces a conspicuous prickly 'cocklebur' and ranges from 0.5 to 6.5 feet in height. Common cocklebur is found throughout the United States and is primarily a weed of agronomic and horticultural crops. The first true leaves are opposite, while all subsequent leaves are alternate.** Flowering season is from July to September. Seeds are the only source of reproduction. Found in open fields, gardens, pastures, and waste areas. Common cocklebur is especially abundant in areas where retreating water has exposed previously submerged land. Learn more about this weed please refer to following link: http://www.ppws.vt.edu/scott/weed_id/xanst.htm. (*Xanthium strumarium,* image source = http://www.ppws.vt.edu/scott/weed_id/xanst.htm).

Common lambsquarters (*Chenopodium album* L.) **(lambsquarters goosefoot, white goosefoot)** is a native of Europe. It is a **summer annual up to 3.5 feet in height capable of producing thousands of seeds. Leaves are alternate, light green, rounded, triangular. Flowers are green, inconspicuous, without petals.** Flowering season is from June to September. Seeds are the only source of reproduction. Found in cultivated crop fields, gardens, pastures, vacant lots, waste ground, and other disturbed areas. Can become a problem weed in no-till situations. Refer to following link to learn more about this weed: http://www.ppws.vt.edu/scott/weed_id/cheal.htm. (*Chenopodium album,* image source = http://www.cloudnet.com/~djeans/FlwPlant/Lambs-quarter.htm).

Common ragweed (*Ambrosia artemisiifolia*) (**short ragweed, annual ragweed, small ragweed**) is a native weed. It is a **summer annual found throughout the United States, producing**

abundant pollen that is a primary cause of hay fever. Leaves are egg-shaped in outline and once or twice compound. Flower heads are, green, and arranged in slender inverted racemes at the ends of branches. Male and female flowers are in separate heads on the same plant, the male flowers are at the top of the plant, while the female flowers are in the upper leaves and bases of leaves. Flowering season is from July to September. Seeds are the only source of reproduction. Found in pasture, rangeland, prairies, and cultivated fields. Refer to following link to learn more about this weed: http://www.ppws.vt.edu/scott/weed_id/ambel.htm. (*Ambrosia artemisiifolia*, image source = http://www.auburn.edu/~deancar/wfnotes/ragwd.htm).

Morningglory (Tall morningglory) is a native of Tropical America. It is **a trailing or climbing annual vine with heart-shaped leaves and purple to white flowers, primarily a weed of agronomic crops, nurseries, landscapes and non-crop areas. Flowers have sepals at the base of the flower.** Flowering season is from June to October. Seeds are the only source of reproduction. Commonly found in cultivated fields, gardens, waste places, and roadsides. Learn more about this weed please refer to following link: http://www.ppws.vt.edu/scott/weed_id/ipopu.htm. (*Ipomoea purpurea*, image source = http://www.museums.org.za/bio/plants/convolvulaceae/ipomoea_purpurea.htm).

Pigweed Family

Palmer amaranth (*Amaranthus palmeri*) and **redroot** (*Amaranthus retroflexus* L.) **(rough pigweed, careless weed)** are native weeds. Flowering season is from June to October. Seeds are the source of reproduction. Found in cultivated and fallow fields, gardens, waste ground, and roadsides. Palmer amaranth leaf and stem surfaces are smoother with few or no hairs than redroot pigweed. It is an erect summer annual that may reach 6.5 feet in height, it closely resembles many other pigweed species. Leaves are alternate, without hairs (glabrous), and lance-shaped or egg-shaped in outline, with prominent white veins on the undersurface. Leaves occur on relatively long petioles. Refer to following link to learn more about this weed: http://www.ppws.vt.edu/scott/weed_id/amapa.htm. (*Amaranthus palmeri*, image source = http://www.ppws.vt.edu/scott/weed_id/amapa.htm).

 **Tumble (tumbleweed, white pigweed)** is a native weed. Flowering season is from June to October. Seeds are the only source of reproduction. Commonly found in dry-land, cultivated and fallow fields, roadsides, and waste places. Tumble main branches are more or less erect, bushy-branched, yellowish-green to whitish in color. Flowers are very similar to those of Prostrate pigweed. Seeds are round and flattened. Refer to following link to learn more about this weed: http://www.gov.on.ca/OMAFRA/english/crops/facts/ontweeds/tumble_pigweed.htm. (*Amaranthus albus*, image source = http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=AMAL).

 **Waterhemps** (*Amaranthus rudis*) **(common water hemp)** is a native weed. Waterhemp plants typically have no hairs on their stem and leaf surfaces. The leaves of waterhemp plants are often glossy and more elongated compared to redroot or smooth pigweed. Stem color of waterhemp can vary from light green to dark red. Female plants may be completely red, completely green, or some combination of red and green. Male plants may exhibit a similar color pattern. Flowering season is from June to October. Seeds are the source of reproduction. Commonly found in cultivated fields, roadsides, marshes, sandbars, riverbanks and waste places. Refer to following link to learn more about this weed: http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=AMRU. (Image source = http://www.weedscience.org/Case/Case.asp?ResistID=5112).

 **Prickly sida** (*Sida spinosa*) **(teaweed, Indian and false mallow)**. It is a summer annual with yellow flowers and very small spines at the base of each leaf and branch. This weed is one of the most common and troublesome weeds in peanuts, cotton, and soybeans. Prickly sida is primarily a weed of agronomic crops, but can also be found in horticultural crops, landscapes, pastures, hay fields, and gardens. Leave arranged alternately along the stem and leaves are oval to lanceolate in outline. Flowering season is from July to September. Seeds are the only source of reproduction. Refer to following link to learn more about this weed: http://www.ppws.vt.edu/scott/weed_id/sidsp.htm. (Image source = http://www.noble.org/imagegallery/

forbhtml/forbs251-300/F2973.jpg).

 **Pennsylvania smartweed** (*Polygonum pensylvanicum* L.) **(Pennsylvania knotweed, pinweed)** is a native annual herbaceous weed. In this species the sheath is smooth and the upper stem is covered with tiny, stalked glands often referred to as sticky hairs. The leaves are alternate. The flowers are pink and have 5 Regular Parts. Blooms first appear in late spring and continue into mid fall. The flowers are in a dense spike like cluster. Seeds are the only source of reproduction. Commonly found in wet soils or sometimes flooded soil of roadsides, ditches, cultivated ground, waste ground, waste places, and pond banks. Refer to following link to learn more about this weed: http://2bnthewild.com/plants/H76.htm. (Image source = http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=POPE2).

 **Velvetleaf** (*Abutilon theophrasti*) **(Indian mallow, butter print, elephantear, buttonweed)** originated from India. It is an annual tap-rooted weed in the Mallow Family; entire plant covered with short, soft, velvety hairs; large heart-shaped leaves; yellow to yellow-orange flowers. Flowering season is from July to October. Seeds are the only source of reproduction. Found in summer crop fields such as sorghum, corn, and soybeans, in waste places, roadsides, and fence rows. Refer to following link to learn more about this weed: http://www.ppws.vt.edu/scott/weed_id/abuth.htm. (Image source = http://www.agf.gov.bc.ca/cropprot/weedguid/velvetlf.htm).

Perennial Weeds

 **Johnsongrass** (*Sorghum halepense* L.) is a perennial grass originated from the Mediterranean region. It is one of the most troublesome of perennial grasses. It reproduces from underground stems and seeds. Leaves have a prominent whitish midvein. The flower head is large, open, well-branched, and often reddish tinged. Underground stems are thick, fleshy, and segmented. Roots and shoots can rise from each

segment. Flourish in warm conditions. Commonly found in moist soil of waste places, cultivated fields, pastures, and roadsides. Refer to following links to learn more about this weed: http://www.nwcb.wa.gov/weed_info/johnsongrass.html and http://www.aces.edu/dept/extcomm/publications/anr/anr-975/Johnsongrass.pdf. (Image source = http://tncweeds.ucdavis.edu/photos/sorha03.jpg).

Yellow nutsedge (*Cyperus esculentus*) (**yellow nutgrass**) is native of Eurasia. It is a perennial with 3-angled stems, long grass-like leaves, yellowish-green foliage, and tubers at the ends of rhizomes. Flowers are in spikelets at the ends of stems. Rhizomes and tubers are present at mature plant. Tubers are produced at the end of rhizomes beginning in late June and continuing into autumn. A single plant may produce hundreds or even several thousand in a season. Most tubers are found in the first 15 cm of the soil. After germination, tubers produce a primary basal bulb beneath the soil surface; the bulb develops fibrous roots, then rhizomes, secondary basal bulbs, and tubers. Flowering season is from July-August. Found in cultivated fields, gardens, and roadsides and could become a problem weed in no-till situations. Refer to following link to learn more about this weed: http://www.uky.edu/Ag/Agronomy/Weeds/yellow_nutsedge.htm. (Image source = http://oregonstate.edu/dept/nursery-weeds/weedspeciespage/nutsedge/nutsedge_habit.html).

Weed Managements in Cotton Production

Successful weed control in cotton requires an integrated various approach including cultural, mechanical, biological, and chemical methods. Another important component of an effective weed management practice is crop rotation.

Cultivation practices just before planting could control small weed seedlings and prepares the bed for seeding. To give cotton a head start on yellow nutsedge, use sweeps or other shallow cultivating tools to dislodge early nutsedge growth before planting. Mechanical cultivation continues to be one of the most effective methods of controlling weeds following cotton planting. Weed seedlings are killed easily when they are small; therefore, schedule cultivations before the weeds deplete soil moisture and while they are easily dislodged.

Herbicides usage could help to reduce weed management costs. To select the most effective herbicide(s), one must know the weed species present and consider the soil type, cropping sequence, and the timing of cultural operations. Weed infestations should be monitored on a field by field basis and weed species and their density and distribution should be recorded accordingly for each field. Only through knowledge of the infestation can one plan an effective, economical weed control strategy. Refer to following link to learn more about weed management in cotton http://www.ipm.ucdavis.edu/PMG/selectnewpest.cotton.html.

Year 2002 Weed Management

Even though various weed species compete for resources with cotton, only a few serious ones were listed as the primary targets for control with herbicides. For the year 2002, almost all cotton planting areas were treated with

herbicides and multiple (3 times on average) treatments received annually. Therefore weed control is one of the important practices for cotton production in Kansas. The survey shows five herbicides (ingredients) were applied in the control of 12 different weeds during cotton production. The following table lists the herbicides used and weeds controlled.

Herbicides and Targeted Weeds

Herbicide (Ingredients)	Weeds targeted
Diuron	Crabgrass, Lambsquarters, Pigweed, other
Glyphosate	Barnyardgrass, Cocklebur, Crabgrass, Fall Panicum, Foxtails, Johnsongrass, Lambsquarters, Morningglory, Pigweed, Shattercane, Velvetleaf, Yellow Nutsedge, other
Pendimethalin	Crabgrass, Lambsquarters, Pigweed
Pyrithiobac sodium	Pigweed, Velvetleaf
Trifluralin	Barnyardgrass, Crabgrass, Foxtails, Johnsongrass, Shattercane, Velvetleaf

The next two tables display the herbicide trade names, modes of action, acres treated, percentage of area treated, and rate. Table '**Herbicide Usage on Cotton at Different Stage'** details the herbicides and amounts used at different stages in terms of plant growth. Overall, weed control is one of the most important practices in cotton production in Kansas.

Herbicide Usage Survey on Cotton

Herbicide (Ingredient)	Trade Name	Mode of Action[b]	Acres Treated	Percent Treated*	Rate (lb a.i./a)
Diuron	Karmex	PS	1470	2.32	1.36
Glyphosate	Glyphomax, Roundup Ultra	EPSP	59859	94.28	0.62
Pendimethalin	Prowl 3.3 EC	SRI	0	0.00	0.00
Pyrithiobac sodium	Staple	ALS	182	0.29	0.03
Trifluralin	Treflan	SRI	1980	3.12	0.81

Herbicide Usage at Different Stage

Herbicide (Ingredient)	Trade Name	Preplant (lb a.i./a)	Preemergence (lb a.i./a)	Postemergence (lb a.i./a)	Directed Postemergence (lb a.i./a)
Diuron	Karmex	1.60	1.12	0.00	0.00
Glyphosate	Glyphomax, Roundup Ultra	0.79	0.72	0.53	1.03
Pendimethalin	Prowl 3.3 EC	0.00	0.00	0.00	0.00
Pyrithiobac sodium	Staple	0.00	0.03	0.00	0.00
Trifluralin	Treflan	0.81	0.81	0.00	0.00

* Percent Treated = (acreage treated with a given herbicide / the total acreage treated (63491 acres)) * 100.
[b]ALS = ALS (Acetolactate synthase) synthase inhibitor: EPSP = EPSP (5-Enolpyruvyl-3-Shikimate phosphate) synthase inhibitors; PSI = Photosynthesis inhibitors; SRI = Seedling root inhibitor.

Among the herbicides used in weed control, Glyphosate is the most frequently used, with more than 94% of the areas treated with a rate of 0.62 lb/acre. Glyphosate only has foliar-activity and is used both as a burn-down treatment prior to crop emergence in no-till, and as a postemergence treatment. Glyphosate can only be applied postemergence to Glyphosate resistant cotton varieties.

Pesticide application methods may very with target pests and crops. The table '**Pesticide Application Methods**' lists application method and its possibility to be applied by farmers.

Pesticide Application Methods

Control Method	Weed (%)	Insect (%)	Disease (%)
Broadcast, ground without incorporation	0.84	40.80	100.00
Broadcast, ground with incorporation	0.04	4.50	0.00
Broadcast, by air (Aerial application)	0.01	28.16	0.00
Spot Treatment	0.00	0.00	0.00
In irrigation	0.03	0.00	0.00
Banded in or over row	0.04	6.39	0.00
Foliar or directed spray	0.04	2.51	0.00
In seed furrow	0.00	17.64	0.00
chisel/injected or knifed in	0.00	0.00	0.00

Pest Non-Chemical Control Approaches

Non-chemical (cultural) control is one of the important approaches to pest control in cotton production in Kansas. The following table '**Cultural Control Approaches**' lists 12 possible cultural approaches used by farmers for controlling cotton pests (weeds, insects, and diseases).

Cultural Control Approaches?

Non-chemical control approaches	Practice Case	Rate1 (%)*	Rate2 (%)**
Releasing any beneficial organisms	2	1.67	1.00
Mowing, burning, or tilling around the fields	9	7.50	4.48
Cultivating during growing season	14	11.67	6.97
Adjusting planting/harvesting dates	13	10.83	6.47
Alternating chemical usage to minimize resistance	14	11.67	6.97
Rotating crops planted	39	32.50	19.40
Utilizing and water management practices	7	5.83	3.48
Cleaning field equipment between uses	20	16.67	9.95
Utilizing treated seed	40	33.33	19.90
Utilizing soil analysis	30	25.00	14.93
Adjusting row spacing or plant density	11	9.17	5.47
Others***	2	1.67	1.00

? Without specified targeted pests (weeds, insect pests, or diseases) in this survey.
* The proportion of growers (among the 120 sampled growers) who adopted a given cultural approach to pest control. e. g., 32.5% farmers used the 'rotating crops planted' approach to control pests.
** The likelihood that a given cultural approach was used by farmers for pest control in cotton production. e. g., there is a 19.4% chance that the approach 'rotating crops planted' was used by farmers to control various pest. Please note that one farmer may use more than two approaches in pest control.
*** Unspecified cultural approaches.

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