Lecture

Introduction Weed Science and Weeds

Discuss weed science as compared with other disciplines; is weed science a discipline? Compare with entomology and plant pathology

Weed Science # relatively new area

Bible makes references to weeds/undesirable plants

U1940 - start of Weed Science with the introduction of the herbicide 2,4-D [2,4-dichlorophenoxyacetic acid]

Pokorny - developed 2,4-D; has growth regulating properties; used in grass crops for broadleaf weed control

Dr. John B. Baker, LSU in 1952 was one of the first to evaluate 2,4-D in rice

Two Universities have Departments in which "Weed Science" in the department name:
New Mexico State University - Department of Entomology, Plant Pathology, and Weed Science
Virginia Tech University (formerly Virginia Polytechnic Institute and State University - VPI) - Department of Plant Pathology, Physiology, and Weed Science

Most of time Weed Scientists are housed in Agronomy or Plant and Soil Sciences Departments

Weed Science - study of ecology, life cycle, and management of weeds

Ecology - relationship between weeds and the environment in which it is grown

Management of weeds; "squirt and rate" or "spray and pray"

UMany people have no appreciation for weed science, yet, weeds are the major pest problem limiting production of most crops

Weed - a plant growing out of place, growing where it is not wanted e.g. a cotton plant in a corn field.

A plant whose virtues have not yet been discovered.

"A weed is but an unloved flower"

Weeds are classified as pests along with insects, diseases, and nematodes

In 1991, estimated average annual monetary loss caused by weeds in 46 crops grown in the US was 4.1 billion.

Some "weeds" are useful, e.g., dandelions - sheep - New Zealand, but in most cases weeds have a negative connotation

Weeds affect everyone in some way

Weed with absolutely no use:

Poison ivy - allergic reactions

Ragweed either giant or common - lots of pollen, allergies, hay fever

Weeds that are not always weeds:

- Garlic - spice, but also a problem in wheat (garlicky wheat)
- Bermudagrass - major forage crop and turf species, but also a major weed problem in many crops
- Johnsongrass - forage crop, but a major weed problem in crops and roadsides
- Morningglory - ornamental used by home owners vs. weed in crops
- Huisache (pronounced wee-sach) - Austin, TX a shade tree similar to a mesquite bush but major problem in South Texas rangelands
- Kudzu - introduced in the U.S. for soil erosion control and for livestock forage; grows over a foot a day; tremendous problem along Highway 61 where it covers power lines and trees

Weeds can be classified as:

Annuals - emerge from seed, set seed and die in less than 1 year; summer and winter annuals

Biennials - vegetative growth the first year, and reproductive the second year (completes life cycle in less than 2 years e.g. wild carrot, bull thistle, common mullein, plantains)

Perennials - survives from year to year (more than 2 years) and has some form of storage organ to sustain the plant; does not depend on seed production but produces rhizomes, stolons, tubers, etc.

History of Weed Control

10,000 B.C. - hand labor, substituted fingers with a sharp stick to remove weeds; Centuries later metal hoe developed

1000 B.C. - Animals used in cultivation (horses/oxen)

100 A.D. - Romans used sea salt as a herbicide (first herbicide)

1731 - Jethro Tull wrote a book on "Horse-Hoeing Husbandry". He advocated planting crops in rows to allow horse to pull a plow to hoe out weeds, i.e., plow the middle out

1908 - Bolley in the U.S. selectively controlled winter annual weeds with table salt (NaCl), iron sulfate, copper sulfate ($CuSO_4$), and sodium arsenite. This was a selective weed control procedure, a major breakthrough. He stated:

"When the farming public has accepted this method of attacking weeds ... the gain to the country at large will be much larger in monetary consideration than that which has been afforded by any other single piece of investigation applied to field work in agriculture."

1920 - Started using tractors substituted for mules

1941 - 2,4-D synthesized providing selective control of certain broadleaf weeds in grass crops.

1944 - Selectivity and use of 2,4-D postemergence in turf was reported (Marth and Mitchell in U.S.) - dandelion and plaintain and other broadleaf weeds

1945 - Principle of preemergence selective weed control was established (Templeman in England)

1950 - 25 herbicides available for public use

1956 - Weed Science Society of America established

1960's - Preemergence herbicides trifluralin (Treflan) and atrazine labeled. Use example of teaweed (prickly sida/iron weed control). This weed not a problem in cotton until Treflan was used . Some farmers thought teaweed seed came in the Treflan can and were observed to strain Treflan through cheese cloth to remove teaweed seeds. This occurrence was due to the removal of grass competion with the herbicide providing space for the teaweed to flourish.

1970's - glyphosate (Roundup) labeled as preplant nonselective herbicide

1980's - overtop grass herbicides, sulfonylurea and imidazolinone herbicides labeled

1990's - transgenic herbicide resistant crops available

Weed science has progressed more in the last 50 years that in the previous 100 centuries especially so in the last 20 years (I have been fortunate to be a part of that period of change)

Corresponding Changes in Efficiency of Agriculture

10,000 B.C. - one farmer fed one Person	1X
1000 B.C. - doubles food production	2X
1731 - Tull's book doubled production again	4X
1920 - doubled again, fed 8 people	8X
1940 - doubled production again	16X
1980 - one person fed 38	38X
Today - over 300 (??) herbicides	>100X

Banning of pesticides is in the limelight; discuss rigorous registration process required by EPA

New products may take 8-12 years to develop at a price of 80 million dollars

Address the organic agriculture issue in regard to food safety, yield limitations, etc.

Americans spend 10-15% of their expendable income for food

Japanese spend 40-50% of their income for food

Africa - Weeds - AIDS: Weeds may have a greater effect on human survival that the AIDS virus
Witchweed, a parasitic weed, can completely devastate a corn crop

Weed Development Over Time

Plant succession - an orderly change in plant community over time

Climax vegetation - the highest level of vegetation that an area will support

Following land disturbance, annual and perennial herbaceous plants are the first stage in plant succession

Louisiana climax vegetation would be hardwoods, oak, hickory, etc. (deciduous forests)
In Iowa the climax vegetation would be short/tall grass prairies, black/fertile soils
In the north western states - conifers

If you abandon land over time it will revert back to the climax vegetation. The normal sucession would be:

Annuals $ Perennials $ Short woody shrubs $ Bushes $ Trees

Farming practices disrupt the normal plant succession, i.e. with farming we are fighting a normal progression toward a climax vegetation and we are maintaining the plant community at early succession stages.

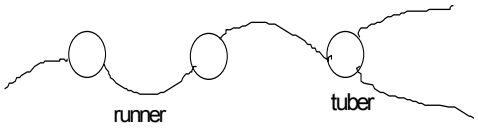
With the shift toward no-till or reduced till practices weed shifts have occurred with more perennial weeds becoming problems

World's worst weed – **purple nutsedge**
Produces tubers in chains

In contrast, yellow nutsedge produces multiple tubers but not in chains (easier to control)

Direct/Indirect Effect of Weeds

1. Competition with crops for:
   light
   nutrients
   water
   space



Mother Nature: "**The most aggressive plant species survives**"; survival of the fittest i.e the one that gets the head start will be more competitive and more efficient at utilizing available resources

Weeds are naturally strong competitors otherwise they would not be weeds

Of the crops, corn is 4x more competitive with weeds than soybean, which is 4x more competitive than cotton

This is why preemergence herbicides are especially important in cotton production to give the crop a head start

Ragweed Plant
needs 3X as much water as corn

Wild mustard vs. Oats
2X - N,P uptake
4X - K uptake
4X - H_2O uptake

In general crops have been bred for yield **not** competitiveness

2. Decrease animal yield - decreased forage production and quality e.g. smutgrass in pastures

3. Hosts for diseases and insects - wild oats host for black stem rust in wheat, oats, barley and weed hosts for aerial blight in soybeans

4. Lower quality of harvested product - increased moisture, foreign matter, etc.

5. Poor field drainage - alligatorweed in bayous and poppingweed (Equisetum sp., scouring rush) around sugarcane fields

6. Human poisoning, dermatitus, and allergies - poison ivy, etc.