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Fundamentals of Seed Production – part two
Seed Production and Management Principles

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Slide 2
This module describes how various agronomic practices (such as field selection, seedling establishment, cultural practices) and environmental stresses relate to seed production and management.

Slide 3
Field selection is an important first step in the path to high quality seed production.

Slide 4
Prior crops in a field rotation, troublesome weed populations, soil characteristics and many other factors are considered in field selection for seed crops.

Slide 5
Seed conditioning and other steps can be used to clean seed lots after harvest, but it is much more efficient to minimize problems using proactive decisions.

Slide 6
Neighboring fields, and associated agricultural practices and native species are also factored in to seed field selection. Wild carrot (Queen Anne's Lace) populations within pollination range of carrot seed is one example of the need for careful scouting and management of seed fields.

Slide 7
Field selection must also consider the optimal conditions for quality seed production of a given species.

Slide 8
Most seed crops clearly benefit from dry conditions, with moderate temps during seed set and plenty of sunshine through the growing season.

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Extremes of temperature, moisture, pest pressure, nutrient levels, and other agronomic traits are detrimental to high quality seed production.

Slide 10
Typical weather conditions during seed harvest are equally important in making location and seed field decisions.

Slide 11
Field preparation steps are very similar to those used in modern crop production.

Slide 12
Seed bed preparation is critical in achieving rapid and uniform seedling establishment of the seed crop.

Slide 13
Variety choices will typically be dictated by the parent company responsible for the seed increase decisions.

Slide 14
Improved traits are constantly being offered in the seed industry, and seed production methods may be adjusted in response to mother plant characteristics and seed quality factors.

Slide 15
Planted seed should be of as high a quality level as possible.

Slide 16
Seed storage, handling, treatments and purity are equally important for seed crop and commercial agricultural production.

Slide 17
Seedling establishment techniques should be tailored to the seed crop in question and many other agronomic or horticultural factors.

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Slide 19
Seeding dates for seed crops are somewhat flexible depending on production targets.

Slide 20
An understanding of local weather and climatic patterns is essential in having good conditions as seed crops (such as *Zea mays*, shown here) reach critical seed development and seed filling development stages.

Slide 21
Weed competition, seeding depths, soil tilth, and other agronomic basics must be considered for consistent success in stand establishment.

Slide 22
Soil fertility and nutrient availability for the seed crop is another fundamental component in seed production.

Slide 23
The art and science of seed production are at work here.

Slide 24
Nitrogen management is especially important.

Slide 25
Phosphorous and potassium comprise the remainder of the ‘big three’ of plant nutrients.

Slide 26
Water is the major limiting aspect in global crop production. Water status must be managed using irrigation (and proper drainage) for best seed yields and quality.

Slide 27
Irrigation, in general, will lengthen the period of reproductive development.

Slide 28
Further research is essential to better understand what constitutes water stress in seed production for various species and seed production regimes.

Slide 29
Many types of irrigation are used for crop and seed production around the world.

Slide 30
Efficient use of water resources is accomplished thru improved irrigation methods, scheduling and moisture status monitoring.

Slide 31
Weed control is also needed to ensure successful seed production.

Slide 32
Specific herbicide or mechanical control recommendations are often specific for each seed production region and country, so check local sources for the most current weed management strategies.

Slide 33
Crop rotations and considerations of weed seed ecology are useful in weed management.

Slide 34
The high value of seed crops often warrants special weed control techniques such as manual or chemical rogueing.

Slide 35
Disease control is another management consideration in high quality seed production.

Slide 36
Site selection and seed field rotation plans are needed for best results in disease management.

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Slide 38
Field management and selection of recommended fungicide sprays, etc. is again specific to seed production regions.

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A final general area of integrated seed crop management is insect control.

Slide 40
Many levels of insect management can be employed

Slide 41
Most seed crops benefit from establishment in soils with excellent tilth and a firm seedbed.

Slide 42
A uniformly tilled seed field is useful in achieving rapid seedling establishment.

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Slide 44
Several factors (such as any vernalization requirements, pest cycles, other) influence sowing dates for seed crops.

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Slide 47
Soil types, access to irrigation and other local seed production factors can influence seeding depth decisions.

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Slide 49

All seed crop establishment decisions are ultimately aimed at achieving an optimal crop density based on seed production objectives.

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Slide 51
Row width decisions, and resulting plant populations are closely linked to final seed yields and quality.

Slide 52
Some seed crop families (legumes, solanaceae) have compensatory growth which may override differences in initial plant population.

Slide 53
Many aspects of seed production are directly influenced by tillage decisions.

Slide 54
Primary tillage is still very common in seed production fields, even as many grain crop producers have employed minimum or no-till practices.

Slide 55
Secondary tillage is also essential for seed production of many species around the world.

Slide 56
Sowing practices are quite similar between seed crops and commercial cash crops.

Slide 57
The many management steps throughout seed crop production puts a special premium on uniform planting.

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Slide 62
Fabaceae (legume) species will be examined as case studies of water stress and colored mulch effects on eventual seed yields and quality. Lima beans are an example of this family, with a wide range of seed and plant types.

Slide 63
Peas (*Pisum sativum* L.) are another legume where seed quality is influenced by environmental factors such as water supply. This figure illustrates four irrigation treatments imposed on a developing pea seed crop. The top curve is cumulative evapotranspiration; the middle curve is rainfall. The bottom curve is cumulative water deficit (in mm). S = sowing date of 'Solara' pea; BF = beginning of flowering; IGF = initiation of grain fill; EGF = end of grain filling {Crop Science 37:1247-1252 (1997)].

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Within-lot variability of mean seed wt. associated with the various irrigation regimes is shown in Fig. 2. Seed weights were higher and more uniform (curve on far right; with rectangle symbols) for the IDSF treatment. (Irrigation stopped at the beginning of flowering, and irrigation resumed at initiation of grain fill, and watered until the end of grain fill. Non-irrigated (NI) plants gave the far left curve; irrigated as needed (WI) plants gave the oval symbol curve; irrigated from flowering to beginning of grain fill (IBSF) (upside-down triangles) gave smaller and more variable sized pea seed (this strategy had been commonly used in France until this research was conducted).

Water stress during seed fill (former commercial practice) was found to decrease the seed yield, but effects on seed quality were not significant (data not shown).

Changing irrigation strategies for seed production of peas (and other crops?) can influence seed yields, and seed size.

Slide 65
Yield and nutrient content of edible beans (eg. *P. lunatus* L.) are important to growers and consumers. Seed plants were grown in rows covered with different colors of plastic mulch (black, red, green, white) to assess plant response to reflected light. Bean seed yield from plants on red mulch plots was greater than on black, green, or white mulch.

Slide 66
In a second year of study, red mulch again was linked to greater seed yields. White mulch yields were intermediate to red and green/black in this year.

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Legume seeds are a major source of protein in the human diet. In year 1, no differences in mg. protein per gram of seed were observed among the 4 colors of mulch. In year 2 (table 4), seed protein measured as gm/plant was highest for plants grown on red mulch. These data again show examples of cultural practice influences on seed yields and quality traits. [Crop Science 44:2123-2126 (2004)]

Slide 68
Many aspects of precision farming may also assist seed production in coming years.

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An example of this is illustrated using research on sweet corn seedling establishment and variable depth of planting. [HortTechnol. 10:341-350. (2000)]

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Crosby silt loam soils (top half of plot map) are lighter colored and tend to crust; Kokomo silty clay loam soils (lower half of map) are darker colored, have higher organic matter and soil moisture holding capacity; note the wide range in sweet corn emergence at the uniform 2 cm seeding depth.

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Some improvement in field stand (more red, less blue) with variable planting depth (2 or 4 cm).

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2 cm only – again emergence rate drops back.

Slide 75
More advances each year in planter technology, soil moisture sensors, other) may assist in seed production goal of uniform, rapid emergence.

Slide 76
Other seed production specifics (organics, etc.) are receiving increased attention.

Slide 77
Overall goal is reliable production of high yielding seed crops and high quality seed for global production of food, fiber, landscape and other species.