

Crop Rotation

GUIDELINES



Crop Rotation

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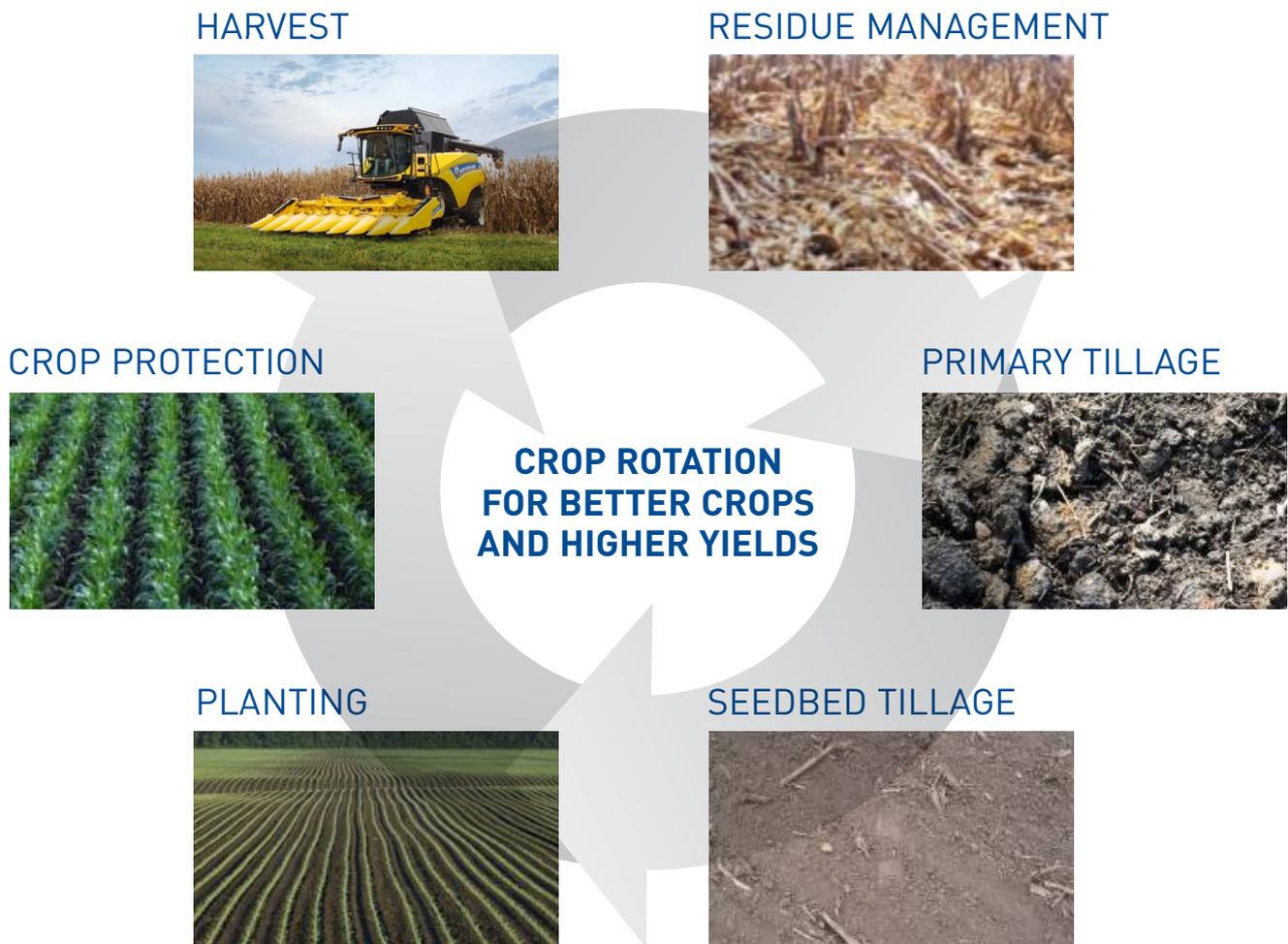
Crop Rotation: general considerations



WHY IS IT IMPORTANT?

- **The term cropping system or crop rotation** refers to the crops and crop sequences and the management techniques used on a particular field over a period of years.
- **Crop rotation, as a rule, improves performances of each crop:** this is consequent to different nutrition and tillage requirements by different crops.
- **Rotation allows to spread operations in different seasons of year,** which eases management of farms concerning labor and operational loads.
- **Cash flow** is spread on different season, thus decreasing risks bound with negative meteorological factors.
- **Exploitation of soil physical and chemical fertility is improved,** as different crops roots explore different layers of soil: also different crops use different amounts of nutrients and require different tillage depths.
- **Structure of soils improves,** because residues from crop roots stay at different depths and residues are also different in chemical composition.
- **Weeds, pests and diseases management gets easier** because different crops have different pests and weeds, on which different chemicals are used: as a whole, pests and weeds are more easily managed.
- **Fallow can enter in rotation with other crops:** such a practice is still spread in many areas of dry wheat cropping in order to re-build fertility of soils.

A SYSTEM BASED ON AGRONOMY



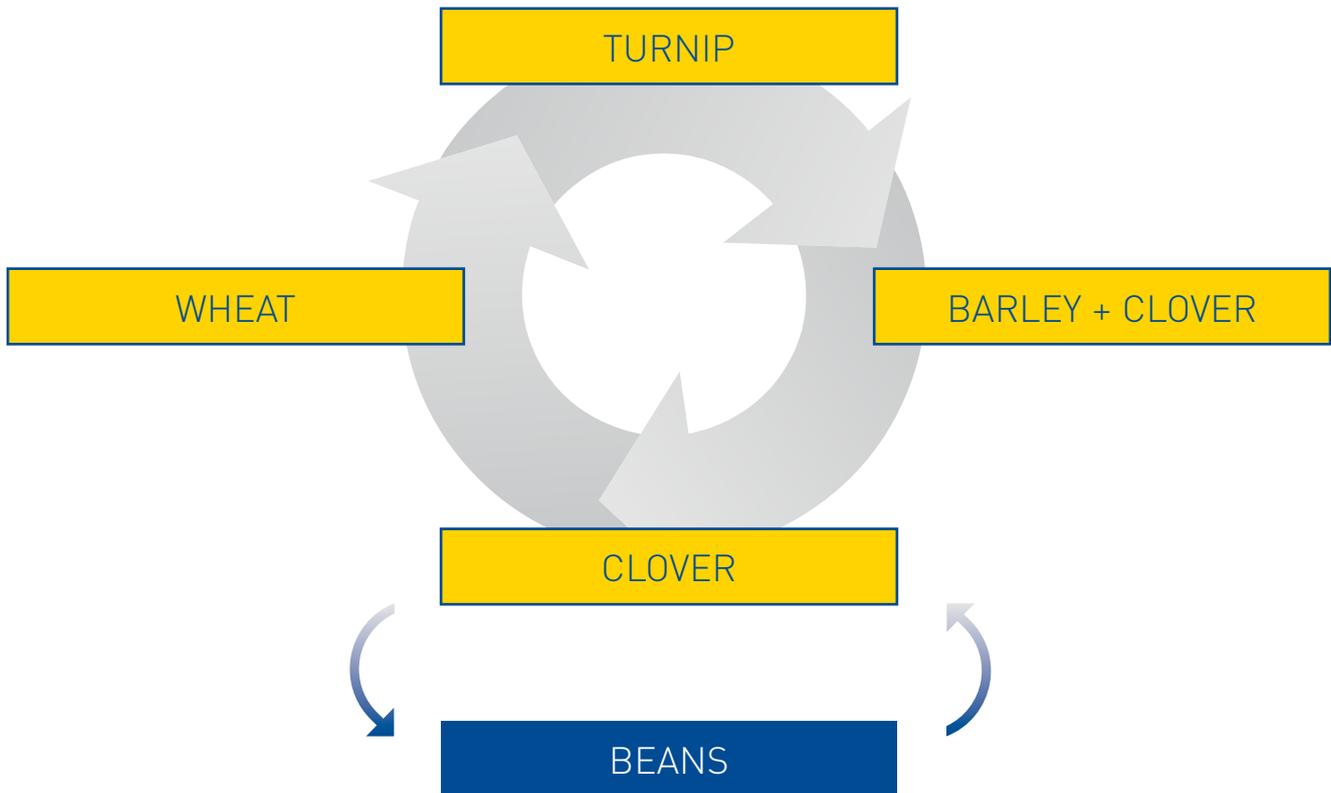
MORE FACTS (SOURCE: ILLINOIS UNIVERSITY MODIFIED)

- **Allelopathy** means the release of a chemical substance by one plant species that inhibits the growth of another species. It has been proven or is suspected to cause yield reductions when one crop follows another of the same botanical family – for example, when corn follows wheat. Technically, damage to a crop from following itself (such as sunflower following sunflower) is referred to as autotoxicity. In many cases the actual cause of such yield reduction is not well understood, but it is generally thought that the breakdown of crop residue can release chemicals that inhibit the growth of the next crop. Keeping old-crop residue away from new-crop roots and seedlings should help to minimize such damage. Also viruses, parasitic weeds and insects are more likely to damage a crop which is planted two years in a row on the same fields.
- **Monocropping**, or **monoculture**, refers to the presence of a single crop in a field during several years continuously. This term is often used to refer to growing the same crop year after year in the same field; this practice is better described as continuous cropping, or continuous monocropping. Although some species better stand monoculture (corn, rice), others species are very sensitive, as e.g. sunflower, soybean, canola and sugar beet).

Crop Rotation historical

#1

NORFOLK ROTATION (1730) A.D.: DEMANDING CROP - CEREAL - LEGUME - CEREAL



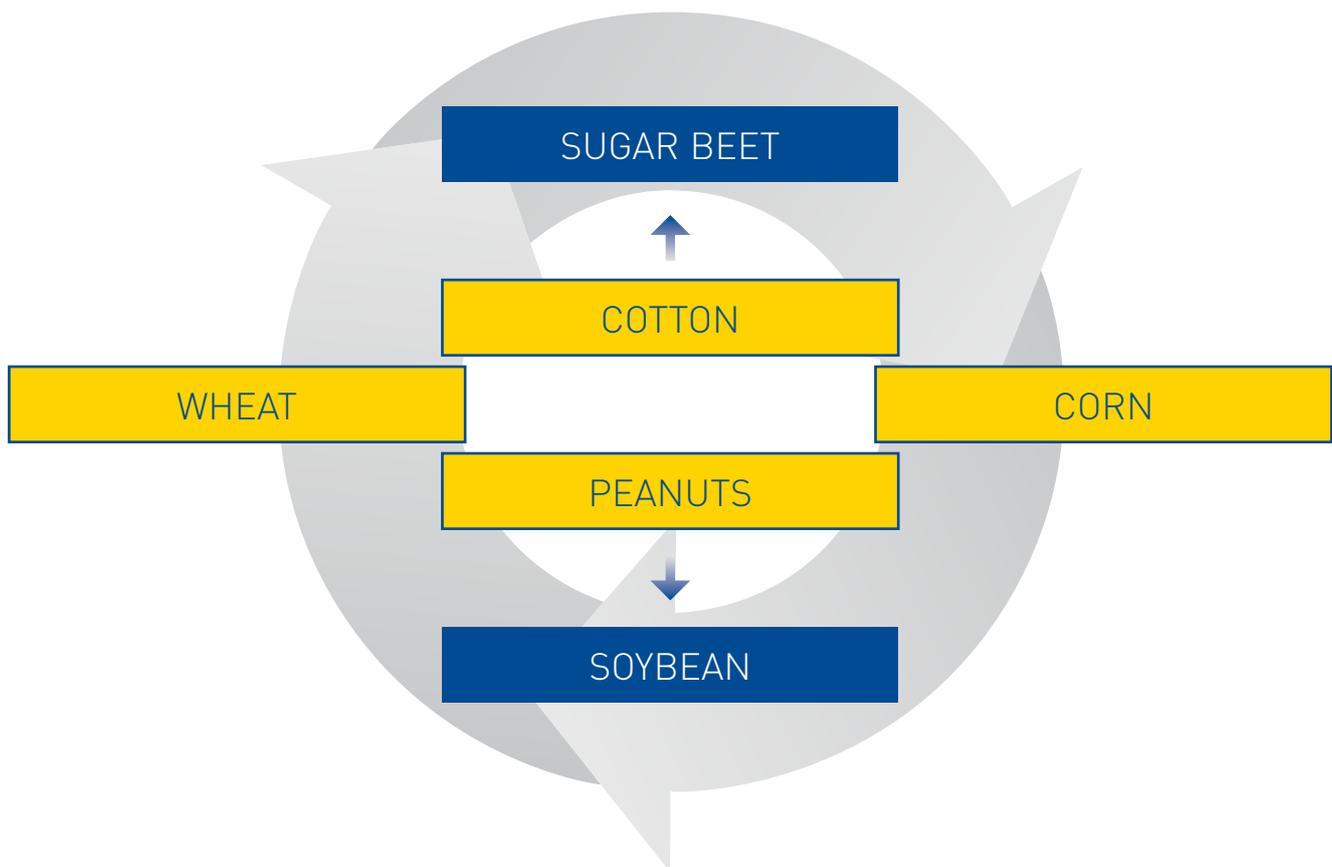
NORFOLK ROTATION (1730, ENGLAND) THE BEGINNING OF MODERN CROP ROTATION

- Although Ancient World practiced fallow and crop rotations, only in 1730 in England rotation began to be widely performed.
- The presence of **legumes in rotation with cereals** allows better performance of cereals, because clover or beans improve the content in N available for wheat in soil. The general point is that after demanding crops (in this case turnip and cereal), an enriching crops follows (clover or beans). So many factors have changed over the centuries (fertilization, more powerful machinery, chemical control of pests, availability of manpower) but nevertheless the basic concepts of rotation are valid till today.
- Main crops, in this case turnip, require deeper and better tillage operations and weed control than cereals, so tilth of soil improves when different crops are present in rotation. The result is a general improvement of soil fertility, structure and thus an improvement of crops performances.
- The presence of **forage crops for cattle** and thus availability of manure has been a must along the centuries. Nowadays it depends on importance of husbandry in the area, because basically the elements of fertility (NPK) can be applied as fertilizers.

Cash crop system - Areas with sufficient moisture

#2

CASH CROP SYSTEM WITH SUFFICIENT WATER AVAILABLE FROM BOTH PRECIPITATIONS AND IRRIGATION



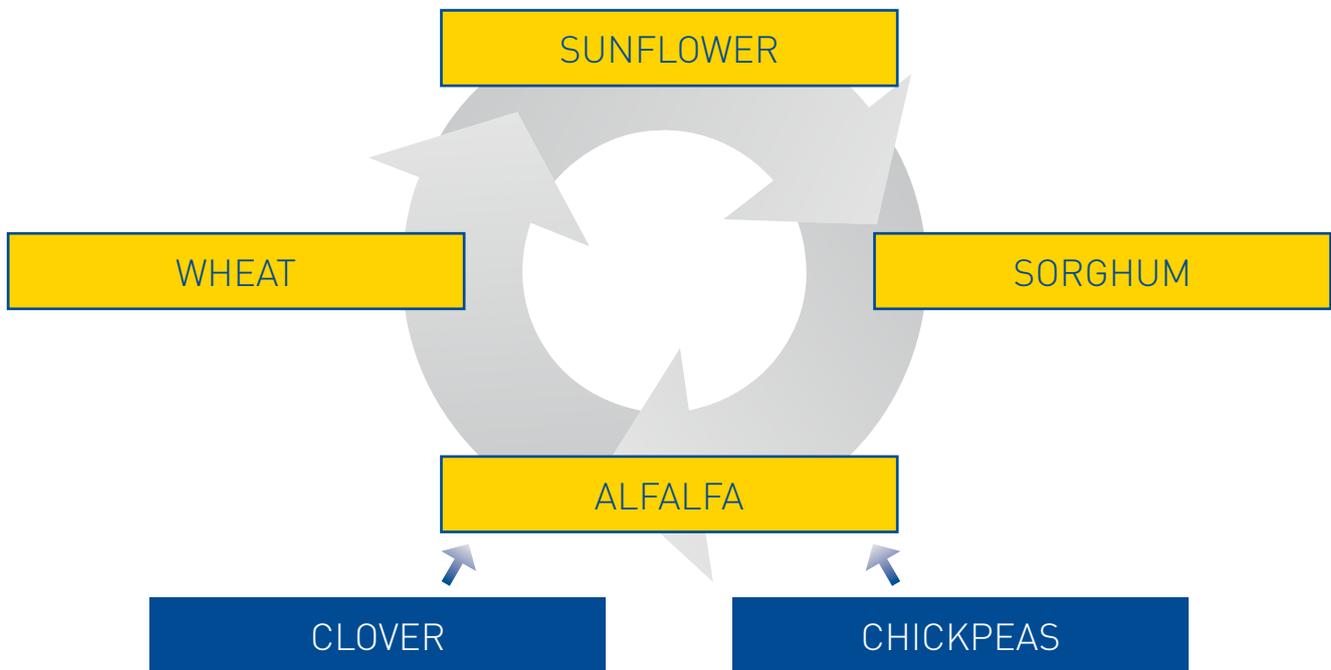
CASH CROPS SYSTEM: SUFFICIENT WATER AVAILABLE PRECIPITATIONS OR IRRIGATION

- This is a typical example of crops with **different requirements** concerning nutrition and tillage: sugar beet is more demanding for P and K, and requires deeper tillage practices, when corn and wheat are more demanding for N and can be cropped with less expensive tillage systems. Soybean, if properly grown, does not require N, conversely increases the content of soil in N through symbiosis with fixing N Azotobacter strains.
- Weed control in these crops is also different: in sugar beet and soybean grass weeds are easy to control, when broad leaves are difficult: the contrary for corn and wheat. So, by rotating the crops, the results of weeds control improves significantly.
- Different strains of **fungi** damage these crops, so such a sequence makes more difficult the building up of spores in the soil: as a result, the pathogens' pressure on crops decreases during the years. This is (relatively) true also for **insects'** pressure.
- Life cycles of different plants are different, so field operations are spread on a broader period. **Timeliness of operations** and distribution of workloads on machinery during the season improves.
- **Tillage** operations are deeper for sugar beet, when minimum tillage can be applied for other crops: the overall result is an improved soil tillage, due to different working depths.

Cash crop in dryer conditions

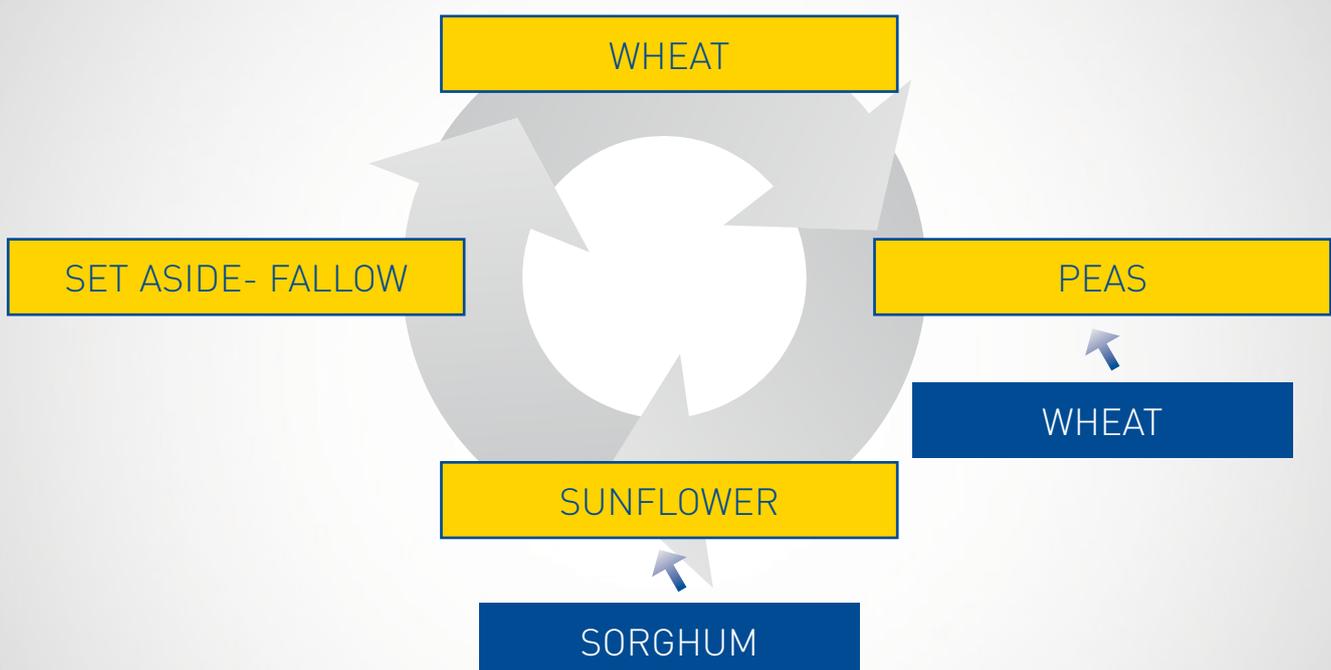
#3

FLEXIBLE CASH CROP SYSTEM IN DRYER CONDITIONS



#4

FLEXIBLE CASH CROP SYSTEM WITH FALLOW IN DRY CONDITIONS



FLEXIBLE CASH CROP SYSTEM: DRYER CONDITIONS, MOISTURE IS A CONCERN

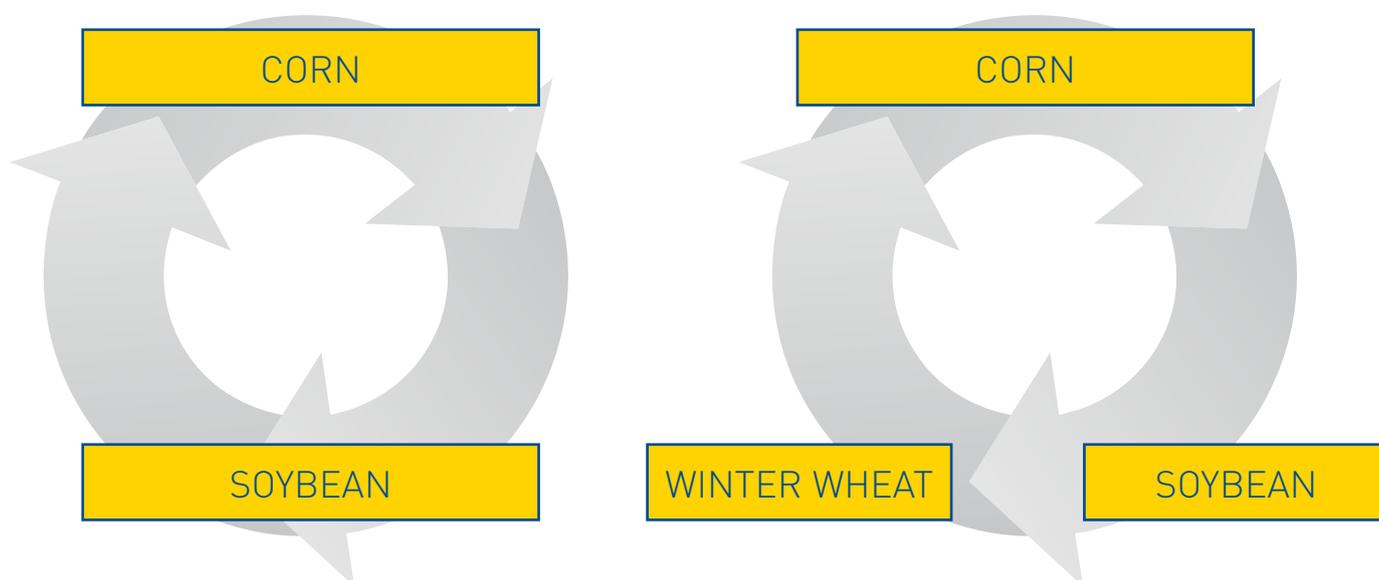
- In these examples, crops that are more **resistant to drought** (sunflower, sorghum, chickpeas and alfalfa) have substituted crops requiring higher levels of moisture in the soil (sugar beet, corn, soybean). Obviously, “resistant to drought” means that such crops are able to wait for water longer than other crops, or have physiological mechanism for consuming less moisture.
- Legumes are anyway present in rotation, both for grain production (peas) and forage production (alfalfa).
- Introducing of **fallow** (set aside) can be a good solution in extensive conditions, where inputs as fertilizers and chemicals are not available in full size, mechanization is not totally sufficient and/or acreages are very large.
- Fallows also allows both mechanical and chemical weeds control and thus the building up of soil moisture, which becomes available for the following crop.



Midwest rotations

#5

USA MIDWEST TWO AND THREE YEARS SYSTEMS (RATHER MOIST CONDITIONS)



Source: University of Illinois

TYPICAL USA MIDWEST ROTATIONS

MOIST CONDITIONS ARE FAVORABLE TO INTENSIVE CROPPING

- Crop rotation is a correct practice also in generally favorable conditions, as we meet in USA Midwest. Considerable effort has gone into trying to explain the yield increases found when corn and soybean are grown in sequence instead of continuous monocropping. One factor is the effect of residue on nitrogen (N) supply. Corn crop residue (stalks, leaves, and cobs) has low N content, so microbes take up N from the soil as they break down this residue from the previous crop, thus tying up some soil N and reducing the amount available to the next crop. Soybean residue is lower in quantity than corn residue, and it has a much higher N content. The breakdown of soybean residue, therefore, ties up little or no N, leaving more for the following corn crop and C: N soil ratio improves.
- Results of Illinois State University research indicate that three-crop rotations including wheat can be economically competitive at current crop price ratios. Drawbacks to the inclusion of winter wheat in northern Illinois include the occasional difficulty in getting the wheat crop planted on time following harvest of corn or soybean. The sequence in which the crops are grown does not affect yields much in most years, but it can be easier to plant wheat following soybean, both because of earlier harvest and because of less crop residue. Minimum tillage practices can help in getting the crop implanted in time.

Source: University of Illinois



Machinery

IMPLEMENTING YOUR GROWTH PROJECTS

- New Holland equipment fits well in different crop rotation and different climatic conditions.
- For deeper tillage, **Disk Rippers and Heavy Offset Disks** can be used.
- For shallower tillage and seedbed preparation, **tandem disks and field cultivators** can be used.
- For minimum and no tillage practices in dry land conditions, **Hoe Drills and Disk Drills** are available.



NEW HOLLAND ST 830 CHISEL PLOW

Chisel Plow is another alternative for primary tillage, Spikes or sweeps mix and revolve the soil less energetically than Disk Ripper, anyway when shallower

primary tillage is necessary, then a Chisel Plow can deliver the needed result.



NEW HOLLAND MINIMUM TILLAGE SEEDERS

Often in crop rotations timeliness is crucial. For example, seeding winter wheat or winter canola in rotation with corn or soybeans at the end of summer or beginning of fall can be a demanding task, because the time window for operations is narrow. New Holland offers implements for matching this challenge.

Hoe Air Drills New Holland P2050, P2060 and P2070 (also branded as FC5000HD, 5500 and PH700) have soil engaging tools as sweeps and openers mounted on shanks. These tools at the same time till the seedbed, partially destroy weeds and put the seeds and fertilizers where they must be, delivering precision and high productivity. Losses of moisture are minimal when compared with conventional cropping patterns.



NEW HOLLAND NO-TILLAGE SEEDERS

In no-till conditions, **P2080 and 2085** precision Disk Drillers deliver a quality seeding with minimal soil

disturbance. Here losses of moisture are even lesser, because disk openers only cut the soil. Weed control is minimal.



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