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## CROPPING PRINCIPLES THAT APPLY TO ALL CROPS?

**I wouldn't consider myself an extensive world traveler, but I have been able to travel some in different parts of the world.**

When in new areas I like to take the opportunity to observe the local farming practices and especially what and how crops are grown... and what nutrient management practices are used. There are differences among areas such as: climate (i.e. temperatures, growing season, precipitation amounts and timing), use of irrigation, crops grown, tillage methods, and types of nutrient sources used. However, even though there are differences I am amazed at the similarities when you compare areas. When considering primarily field crops the following cropping principles are important all over the world.

**First is the tillage and seedbed preparation system. In order to grow an annual crop, or establish a perennial crop, either seeds or plant propagation parts are placed in soil.** This usually involves a primary intense tillage operation (e.g. plowing, disking, or even hand hoeing), followed by a secondary tillage operation or two (e.g. cultivating, harrowing, or even raking) to smooth the soil surface and establish a suitable seedbed. In the case of no-till or conservation tillage systems some or all of the tillage operations are replaced by the use of pre-plant, non-selective herbicide applications for weed control, followed by planting using specialized residue clearing equipment.

**Application of supplemental plant nutrients is usually practiced. Most often this is in the form of fertilizer or recycled biosolids (e.g. animal manures, crop residues, sewage sludge, and or green manure crops), or a combination of fertilizers and biosolids.** The aim is to effectively apply the nutrients using the 4R Nutrient Stewardship Principles of applying the right source of nutrient at the right rate, right time, and right place, so that adequate nutrients are available to the crop to optimize crop yields, net returns for the farm, and minimize any unwanted nutrient movement away from the field in surface run-off, leaching into groundwater, or gaseous emissions and losses of N (e.g.  $N_2O$  and  $N_2$ ). Depending on the nutrient, its application can be done as a pre-plant operation, at planting, or an in-season top-dressing. Often non soil-mobile nutrients such as P, K, and most micronutrients are applied and incorporated before planting using pre-plant tillage operations, placed in the seed-row furrow with the seed, or a precision side-band as part of the planting operation. The two soil-mobile macronutrients (i.e. N and S) can be successfully applied as an in-season top-dressing, usually within a couple of weeks to one month after planting, but in low-to-moderate rainfall regions they can be applied as pre-plant or at planting operations as noted above. High rates of N need to be placed away from the seed furrow to avoid excess  $NH_3$  toxicity, or an adverse osmotic salt effect.

**The planting operation is critical for crop establishment so that crop seeds or plant propagation parts (e.g. potato tuber pieces), are placed into the seedbed with adequate soil contact at the appropriate depth to access soil moisture and germinate well.** This usually is done using a planter that has a soil engaging disk or hoe-type soil opener that makes a small furrow into the soil, the seed is placed in the bottom of the furrow, and soil is placed over the seed followed by moderately packing so that the seeds will absorb (imbibe) soil moisture and germinate well. Many planters are equipped with fertilizer tanks and distribution systems so that fertilizer can be seed-row applied or side-banded as discussed above. It is most interesting to me how these same correct planting methods are used whether the farm is highly mechanized or is done using animal or human power.

**There needs to be in-crop weed control and pest control done.** This is often done using herbicides, insecticides, and fungicides as spray applications. However, weed control in some areas and crops is done effectively using between crop row tillage, or even hand weeding.

**The harvesting of crops needs to happen in a timely manner so the crop is ripe enough for storage and transportation, while avoiding excess exposure to weather, and damage by rodents or birds.** Adequate storage is critical for preserving the quality of the harvested crop parts (e.g. grain or forage) until the farm products are used on-farm or sold off-farm for needed cash income.

**The last stage of cropping done is crop residue management by evenly spreading, or in some cases removing non-harvested crop residues to facilitate tillage and planting operations the next growing season or period.**

**If any of these principles is done poorly or neglected anywhere in the world, the growing of a successful crop and adequate returns to the farmer are compromised.** Fortunately, in my observation farming practices in most areas are well done and grow adequate crops for feeding the human family. I encourage you to make your own observations of cropping practices when you travel outside your local region.

–TLJ–

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Abbreviations: N = nitrogen,  $N_2O$  = nitrous oxide,  $N_2$  = dinitrogen,  $NH_3$  = ammonia, P = phosphorus, K = potassium, S = sulfur.

Note: *Plant Nutrition TODAY* articles are available online at the IPNI website: [www.ipni.net/pnt](http://www.ipni.net/pnt)