Rotational Intensity

Rotation intensity is the level of demand for water created by the rotation. Cropping more frequently and including a larger proportion of high water using crops in a rotation will increase intensity. The level of water use by the system should match the water available under "normal" conditions. If fields are consistently too wet, then the current rotation lacks intensity. If fields are frequently too dry, intensity is too high. Using rotations that have both high and low intensity segments or employing multiple rotations which vary in intensity helps to protect against variable weather conditions.

Soil water holding capacity and water release characteristics are major considerations in determining proper rotational intensity. Deep soils with medium soil textures and high organic matter content will support the most intensity in any given climate. Shallow soils and soils with limited rooting depths, sandy textures, and/or low organic matter content limit the amount of rotational intensity that is possible.

Soil and climatic characteristics play a major role in determining how proper intensity is attained. For instance, a wheat-millet-canola rotation has the same average intensity as a wheat-sorghum-fallow rotation. The latter rotation would not be proper on a soil with limited water holding capacity since this soil can not store deep carryover moisture from the fallow and wheat years for use by the sorghum. Similarly, the first rotation would not be appropriate on a deep soil with high water holding capacity since none of these crops is capable of exploring sufficiently deep in the soil to fully utilize its capability.

Since tillage uses water, no-till rotations (in almost all cases) **must** be more intense than where tillage is used. Failure to use the extra water in a soil under no-till management increases weeds and diseases; lowers profits; increases saline seep problems; etc. In arid and subhumid areas where tillage based rotations contain fallow and/or a substantial proportion of low water use crops, intensity can be increased by eliminating or decreasing the amount of fallow; using cover crops in lieu of fallow (green fallow); shortening the fallow period; and/or growing or increasing the proportion of high water-use crops. In humid areas where conventional rotations consist entirely of high water use crops, intensity is increased by using double crop and/or cover cropping practices.

Several generations of experience in an area have probably found the appropriate level of intensity for tillage-based systems. This is not so with no-till cropping systems; other approaches are needed to determine and test initial rotational intensities when tillage is not going to be used.

One approach is to utilize local no-till rotational research results and experiences of neighbors who no-till under similar soil and climatic conditions.

The other approach is using a simplified method of calculating average rotational intensity (demonstrated on page 4). This approach allows comparisons of rotations that differ from the rotations used locally.

For those producers where no-till research and grower experience is not readily available, two methods are useful:

- The best draws on experiences of no-till producers in areas that have native vegetation characteristics similar to the area of interest. The native vegetation types that develop on any given site are indicative of the relationship that exists between the climate (rainfall, heat, etc) and the soil characteristics. Since these are the factors that determine proper rotational intensity, locations that share similar native vegetation also will require similar rotational intensity. Crops and methods used to obtain this intensity level may differ appreciably, however, depending on the circumstances.

- Another method has been successfully used on the land in question with conventional tillage. The starting point is calculating the intensity using the procedure on page 4. Then, increasing the rotational intensity by a factor of 33 to 300 percent. The lower amount applies where soil characteristics, climate, or crop choices severely limit the ability to store water or utilize water at deeper levels in the soil profile. The larger increase applies to situations with excellent soil characteristics, where surface residue levels are maintained at high levels, and the operator has the ability to withstand occasional low-income years in exchange for potentially higher average profitability.

Attaining proper crop intensity for any particular soil-tillage-operator situation assures that the most efficient amount of water is available for the crops in the rotation. It does not mean that there are never water deficits or that problems with excess water will not occur; just that the probability of these problems occurring has been minimized as much as possible in light of the available climate and soil characteristics, the tillage system used, and the operator's preference. Some operators may opt to use intensities at the low end of the appropriate range that increases the probability of excessive wetness while decreasing the chance of drought. Others may choose intensities near the high end of the range. Still others will use combinations of rotational intensities to spread risks.

It has been assumed that efforts to attain proper rotational intensity will be paralleled by a commitment to create adequate diversity in the crop rotation. This assures plants are healthy with healthy root systems that can take full advantage of the moisture available without having to share that resource with excessive numbers of weeds or lose yield potential to diseases, insects, or lack of nutrients

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