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Minimizing the Effects of Poor Sugarcane Stands

Sugarcane stand establishment is crucial to produce profitable yields throughout the crop cycle. In this article, we will review some reasons for stand problems, discuss sugarcane's ability to compensate for these problems, and describe cultural practices that may increase yields where stands are non-optimal.

The first step to adequate stands in every crop year of the multi-year cycle is the adequate establishment of the plant-cane crop. Yield losses associated with large gaps in a plant-cane crop continue into the subsequent first- and second-ratoon crops, but the greatest yield reduction occurs in the plant-cane crop (Arceneaux and Stokes, 1939). It is essential that plantings be made in well-prepared seedbeds using seed cane that is free or nearly free of disease. Emergence can be further enhanced if the seed cane is free of mechanical damage that may occur during its harvesting and planting. Mechanical damage during the harvesting of seedcane can damage about 4% of eyes, and mechanical planting can decrease the number of buds that are capable of germinating by an additional 10% (Dafaalla and Hummeida, 1991). Thus, before the cane is even covered with soil, almost 15% of the eyes may not be viable. It is recommended that growers use additional seed cane when seed cane quality is questionable.

Damage can also occur due to inadequate or excessive amounts of soil placed over the freshly planted cane. Harsh herbicide applications can decrease yields especially where soil cover is inadequate. Richard and Dalley (2006) demonstrated that in plant-cane, reducing soil coverage from 10 to 5 cm reduced cane yield, TRS, and sugar yield. Terbacil, azafenidin, and terbacil combined with diuron reduced cane yield, and terbacil and terbacil with diuron reduced sugar yield when cane was covered with 5 cm of soil. Thus, soil coverage will not only affect emergence but will also influence herbicide damage depending on the type of chemical weed control used. Excessive soil, especially on soils that crust, can form a physical barrier preventing shoots from emerging. Adequate soil coverage dictates the below ground development of the stubble and the number of nodal buds available for germination in the subsequent ratoon crops. It also allows for the anchoring of the stubble piece which is especially important in the mechanical harvesting of lodged cane as will be discussed below.

There has been considerable amount of research conducted on the compensatory ability of sugarcane following inadequate stands. White and Richard (1985) investigated stand loss by removing 0, 25, 50, and 75% of the emerged sugarcane shoots 2 to 5 cm below the soil surface in both mid-March, mid-April, and mid-May in plant-cane and first-ratoon fields of sugarcane. The plant-cane crop compensated better when exposed to stand reductions than the first ratoon. Reductions in sugar yields increased as the date of shoot removal during the crop season was delayed. Sugar yields were affected by a 25% removal of shoots only when the removal occurred in mid-May during the first-ratoon crop. Reductions in sugar yield averaged 8% and 13% when a respective 50% and 75%, of the shoots were removed in mid-April or mid-May. In Louisiana using CP 70-321, research has indicated that cane can compensate for gaps as large as 90 cm, and that every 1% of meter row with gaps greater than 90 cm resulted in an average of 1.20 Mg/ha loss in cane yield (Richard et al., 1990). A similar study, conducted by the American Sugarcane League and the ARS Sugarcane Research Laboratory in 2008 using a variety that produces stalk populations lower than CP 70-321, showed similar results.

There are certain cultural practices that may aid in decreasing the effects of poor stand establishment. Applications of vinasse, up to 75 t/ha, have been shown to increase tillering and yield (Li et al., 2007). Furthermore, optimal nitrogen rates increased tiller vigor, number and retention, and cane and sugar yields (Shuckla, 2003); application of nitrogen near the time of maximum tiller numbers increased tiller survival (Bell and Garside, 2001). Adequate weed control is essential in fields with gaps to prevent the crop that is already trying to compensate for low plant population, from having to also compete with weeds for nutrients, moisture, and sunlight. Murayama et al. (1990) showed that gap-filling with pre-germinated setts increased cane and sugar yield by 7% in plant-cane. The labor cost for gap-filling may make this an uneconomical endeavor. Other less labor-intensive cultural practices may aid in increasing stands. Shaving several cm of soil off the top of dormant ratoons can increase stands where emergence is delayed. Removal of the soil allows for shoot emergence from the lowest buds. The level of soil to be removed depends on planting depth, in-season tillage practices, soil type, stubble age, and variety.

Practices used during the mechanical harvesting and in-field transport of cane and post-harvest management practices can increase yields in the subsequent ratoon crops. Excessive harvester speeds lead to above-ground stool damage which consequently allows for pathogen entry to below ground buds. Once damaged, the buds are susceptible to diseases such as red rot, which can completely destroy them. In addition, a reduction in harvester ground speeds can reduce physical damage to below ground buds. If the harvester is traveling too fast or if the base cutter blades are blunt, the entire cane stool will be damaged and in some cases pulled out of the ground

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(McDonald, et al., 2006). As mentioned previously, planting depth can influence the amount of stubble pulled out of the ground during mechanical harvesting. Other harvester research indicates that cut heights above the soil surface as opposed to cutting at ground level may increase tillering and yields as a result of stored sugars in the base of stalks improving sprouting under unfavorable weather conditions (Viator et al., unpublished data). Base cutter blades should be sharpened or replaced frequently to minimize the splitting of stalk pieces near the ground level. Damage to below ground stubble buds can also occur when harvesters and field transport equipment are allowed to travel close and/or on the planted lines of sugarcane (Garside et al., 2006). Establishing controlled traffic areas and using row spacings that fit the machinery is one way to alleviate this problem.

Post-harvest residue generated during harvesting can have both a positive and negative benefit on stand establishment and crop yields in the subsequent ratoon crops depending on the environment. In tropical areas where moisture is periodically a limiting factor and where cane is grown for 12 to 24 months before harvest, residue retention actually is beneficial to yields due to moisture conservation as long as the thickness of the residue layer does not form a physical barrier to cane emergence. Non-tropical areas often have excessive rainfall and retention of moisture due to the residue can be excessive and actually reduce stands. In Louisiana, the negative insulating effect of the residue not only keeps the soil saturated but also keeps the soil cooler. As a result shoot emergence is slowed resulting in a further shortening of the already short growing season.

To conclude, proper planting and harvesting is the best way to achieve optimal yields over the complete cane cycle because sugarcane has limited compensatory ability for gaps greater than 90 cm. Where gaps are present during crop emergence and crop growth is slow during the start of the growing season, insuring that weeds are controlled, fertilization is adequate, and post-harvest residues are managed, can help to reduce the impacts of gaps and slowed emergence on yields and profitable longevity of the crop cycle.

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