Dry Soil Planting of Sorghum for Variable Onset of Rains in Ethiopia

Feyera Merga, Kindie Tesfaye, and Charles Wortmann*, Ethiopia Institute of Agricultural Research, CIMMYT-Addis Ababa, and University of Nebraska-Lincoln

Soil water deficits during crop establishment and early growth often constrain sorghum production in Ethiopia. Dry soil planting was evaluated as a means to take advantage of early rains and increase time for crop growth before rains cease in late September to early October. Trials were conducted to evaluate the effect of dry soil planting depth with three water deficit scenarios and two varieties.

Four trials were conducted at Welenchiti (8°40'N, 39°26'E, 1600 m elevation) and Miesso (0°14'N, 40°46'E, 1470 m elevation) in the Central Rift Valley on vertic clay loam soils. The factor levels were:

- varieties (local Masuki Adi and improved Meko)
- planting depths at 3-, 5-, and 7-cm depths, and broadcast seed randomly incorporated to 10-cm by hoeing
- soil water deficit regimes: 30, 15, and 0 mm water applied after dry soil planting followed by 30 mm added for all plots 15, 20,and 25 days later.

100 seeds were sown in plots of 1 m^2 (Fig. 1).

Figure 1. Dry soil planting of sorghum in Ethiopia

Results

Application of 30 mm of water after planting followed by no water application for 15 days was especially detrimental; many plants emerged with this water deficit scenario but died during the 15-day period dry period (Fig. 2). Sorghum better tolerated the water deficit with no water applied at planting and seed lying in dry soil for 15 days before water was applied, compared with water deficits scenarios involving water applied after planting.

Figure 2. Emergence but much plant death during a 2-week dry period following water application at planting.

Depth of planting accounted for much of the variation in treatment means for surviving plant m^{-2} (61%) and individual plant dry wt. (57%). Several interactions affected plant m^{-2}, plant wt., and leaf $plant^{-1}$ but accounted for little variation compared with planting depth, and were magnitudinal rather than directional (Fig. 3, 4). Survival was better and the plants were larger with planting at 5-cm depth compared with other planting practices.

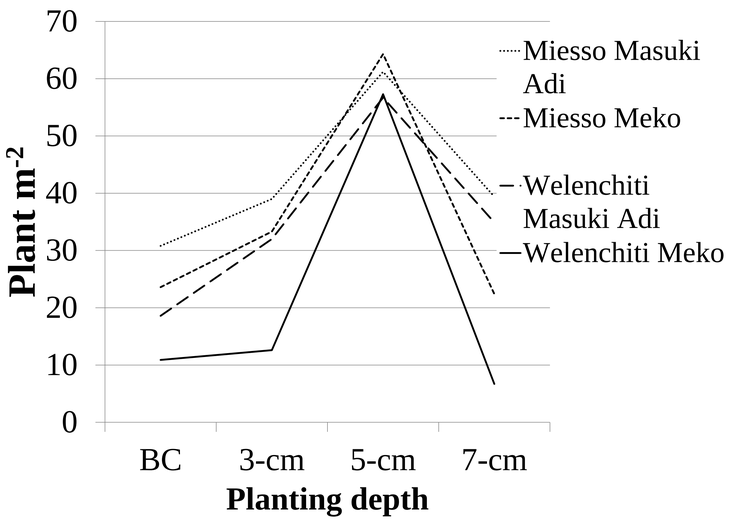

Figure 3. Effect of location x variety x depth interaction on plant m^2.

Dry soil planting sorghum at 5-cm depth, for all water regimes, resulted in relatively better seedling emergence and plant survival as compared with other dry planting depths. Performance was better with the local compared with improved Meko variety. The best establishment was with sorghum planted at a depth of 5-cm with 0 mm water applied until 15 days after dry planting followed by 30 mm applied at 15, 20 and 25 days after planting (Fig.4 and Fig 5).

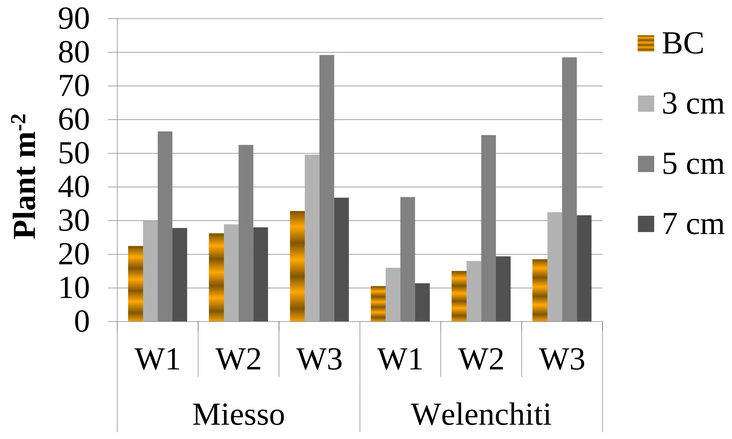

Figure 4. Effect of location x depth x water regime interaction on number of survived plants.

Fig. 5. Establishment of Masuki Adi dry soil planted at 5-cm depth with no water applied until 15 days after planting.

Conclusion

Dry soil planting of sorghum is feasible for Vertisols in semi-arid areas of Ethiopia. Prolonged dry periods following rainfall sufficient to germinate the seed but inadequate to support the seedling is more detrimental than for the seed to lie in dry soil for 15 days and likely longer. Historical weather information needs to be analyzed to determine the risk of having germinating rainfall after dry soil planting followed by an extended dry period for the 10-day periods of June and early July.

Dry soil planting at 5-cm depth is clearly superior to other dry soil planting depths for emergence, seedling survival, and plant growth. Local varieties, products of natural and farmer selection under such management and climatic conditions, appear to be superior to released varieties for dry soil planting in Ethiopia. Dry soil planting on Vertisols at 5-cm depth with a local variety at a time when risk is low for having a germinating rain followed by a prolonged dry period is a feasible practice for adapting to highly variable onset of rains in the Central Rift Valley of Ethiopia. Increased sowing rate will increase the chance of having adequate plant stand.