DECISION SUPPORT TOOL FOR SORGHUM PRODUCTION UNDER VARIABLE RAINFALL IN THE CENTRAL RIFT VALLEY

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Introduction

Sorghum is produced in the Central Rift Valley (CRV) of Ethiopia as one of the staple foods. However, there is high variability in the amount and timing of the rainfall received across the valley and this increases the risk associated with the tactical decisions around planting and cultivar choice. The uncertainty about the upcoming rainfall season has contributed to the effects of the recurring droughts and crop failure. A rainfall analysis alone does not provide sufficient information to the producers; it needs to be accompanied by the prediction aspect provided by seasonal rainfall forecasts. However, the use of probabilities to communicate the seasonal rainfall has been questioned, with suggestions made that they need to be more user friendly (Wylie, 1996). Contrasting with the variability of the rainfall pattern (Haile, 1988) is the relative stability of soil characteristics at a given site. Thus the physical soil water storage properties for the effective depth available, such as the drained upper limit, lower limit and plant available water capacity can be measured or characterized from other parameters (Ritchie, 1999) and then used in the decision making process. The components that provide management possibilities for change are the sowing date, the cultivar choice, the planting density and the fertilizer application level (Diga, 2005). This then becomes a complex decision making process as there are also a number of cultivars available and a range of planting dates at any one site and a range of soils across the CRV. The objective was therefore to develop a simple, but conceptually strong, reflective and potentially innovative ‘what if’ decision support tool (DST) centered on the use of the available seasonal climate forecasts. Following detailed analyses of rainfall patterns and grain yield risk in CRV, the DST called ABBABOKA was developed to assist decision making in this complex farming system.

Methodology

The inputs include the current seasonal forecasts from the Ethiopian National Meteorological Services Agency (NMSA) and from the regional center IGAD Climate Prediction and Application Centre (ICPAC) in Nairobi. The March to September long-term monthly rainfall data from 25 weather stations situated in the study area were also used to make a prediction using the sea surface temperatures. Each of these sources provides a prediction in the form of probability of rainfall to be in the following categories: B = below normal; N = near normal or A = above normal for a particular time period. The logic followed in ABBABOKA is that if any two of the forecast sources gives an A and the other gives an N prediction then the outlook is considered to be good (i.e. above normal rainfall), and the model gives a signal to go ahead and plant sorghum. If one of the sources gives a B prediction, then the end users are advised to consider the current soil water status before making a decision (Diga, 2005). If the outlook is for below normal rainfall from any two of the three sources then the message is to continue in a fallow cycle (i.e. not to plant). If there are a range of outlooks (i.e. combinations of A and N with one B) from the various sources, then the model makes an estimate of the plant available water before giving a message. If the soil profile has a plant available water of more than half the plant available water capacity then the advice will be to plant sorghum, however if the soil water is less than half the potential capacity then the farmers will be advised to delay
planting and remain in a fallow situation. Thus ABBABOKA provides recommendation to the farming community concerning the planting of sorghum for the current season based on the available scientific information and seasonal forecasts. It includes results from the 27 decision options giving the flexibility to choose a variety of a specific length under the various rainfall outlooks provided by the climate service provider sources.

**Results**

ABBABOKA also provides a map showing the homogeneous rainfall zones of the Central Rift Valley that were developed from the long-term monthly rainfall data of the 25 weather stations. The seasonal crop water requirement satisfaction index (WRSI) is used to monitor the extent to which the water requirements of a given crop have been satisfied through the growing season. As there are at least four different sorghum varieties with a range of lengths of growing season from 90-days, 120-days, 150-days to 180-days, the WRSI needs to be calculated for each of the varieties in each of the homogeneous rainfall zones from each of a range of possible planting dates. The planting dates can be as early as March and April for any of the varieties, and then as the season progresses the number of variety options decreases as the longer season varieties would be unable to complete their growing cycle before the soil water is totally depleted. So only the 90-day and 120-day varieties can be planted during May and June and only the 90-day variety as late as July. As there are a total of 14 possible combinations of varieties and possible planting dates, “ABBABOKA” provides maps of the CRV to show the areas suitable for planting each of the varieties at each of the possible planting dates. These maps provide useful information for extension officers and NGO workers, allowing them to distribute the necessary information concerning variety selection to the farmers in each of the homogeneous rainfall zones. The prediction part gives advice on planting decisions for a given month and a specific zone, such as ‘go ahead and plant a sorghum cultivar of 180-day variety, with 100kg/ha DAP (basal and 50 kg/ha (side dressing) with 33000 plants/ha’, depending on the outcome of the combination of factors.

**Conclusions**

The decision support tool ABBABOKA is expected to provide a good starting framework for answering many of the practical farm questions for CRV farmers, researchers and extension workers alike. It combines an understanding of the risks associated with rainfall prediction and the performance of the various sorghum varieties at a range of planting dates under the soil conditions in the CRV. It provides a useful tool as the basis for co-learning activities amongst the farmers, extension workers and researchers through the generation of “what if” scenarios.

**References**

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