Geophysical Research Abstracts
Vol. 17, EGU2015-6079-1, 2015
EGU General Assembly 2015

Bridging dry spells for maize cropping through supplemental irrigation in the Central Rift Valley of Ethiopia

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Abstract
Maize yield in the Central Rift Valley of Ethiopia (CRV) suffers from dry spells at sensitive growth stages. Risk of crop failure makes farmers reluctant to invest in fertilizer. This makes the CRV food insecure. There are farms with well-maintained terraces and Rain Water Harvesting (RWH) systems using concrete farms ponds. We tested the hypothesis that in these farms supplemental irrigation with simultaneous crop intensification might boost production of a small maize area sufficient to improve food security. Intensification includes a higher plant density of a hybrid variety under optimum fertilization. First we assessed the probability of occurrence of dry spells. Then we estimated the availability of sufficient runoff in the ponds in dry years. During 2012 (dry) and 2013 (wet) on-farm field research was conducted with 10 combinations of supplemental irrigation and plant density. The simplest was rainfed farming with 30,000 plants ha-1. The most advanced was no water stress and 75,000 plants ha-1. Finally we compared our on-farm yield with that of neighbouring farmers. Because 2013 was a wet year no irrigation was needed. Our long term daily rainfall (1970-2011) analysis proves the occurrence of dry spells during the onset of the maize (Belg months March and April). In March there is hardly enough water in the ponds. So, we advise later sowing. Starting from April available water (runoff from a 2.2 ha catchment) matches crop water requirement (for 0.5 ha maize). Significant differences between grain and total biomass yield were observed between rainfed and other irrigation levels. However, since the largest difference is only 12%, the investment in irrigation non-critical drought years is not worth the effort. There was also a limited effect (18-22%) of increasing plant density. So, we advise not to use more than 45,000 plants ha-1. The grain yield and total biomass difference between farmers own practice and our on-farm research was 101% and 84% respectively in 2012. This large increase in grain yield is contributed to the higher use of (150% recommended) of fertilizer against the current use (50% or less) by adjacent farmers. Our hypothesis was that supplemental irrigation in combination with increased plant density would greatly increase grain yield. This hypothesis could not be proven with our 2 years experiment. Our experiment, once again, suggests that yield lower than attainable is not a matter of water shortage but rather an effect of lack of fertilizer.

Key words: Maize; Plant density; Supplemental irrigation; Water harvesting; Yield; Water productivity

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