Rice-sweetpotato rotation system: Improving rice yields and profitability by utilizing irrigated rice schemes for off-season production of sweetpotato vines and roots

SASHA Sweetpotato Action for Security and Health in Africa

AUG 2017

Jimmy Lamo, Rice Breeder at the National Agricultural Crop Resources Research Institute (NaCRRI), Uganda observed in an on-station trial, that the rice seed produced on a plot where sweetpotato had previously been planted had higher seed purity. His curiosity has led to a collaboration with the International Potato Center (CIP) to test rice-sweetpotato rotations in irrigation schemes in northern Uganda. Analysis of the first rotation shows a statistically significant net profit ratio from the rotation of 2.0, compared to 1.8 for the control.

Fig. 1 Damalie Ikeba (extension worker), poses with seed entrepreneurs; Okot Christopher and Lapat Ernest with Kabode roots after harvesting the rice-sweetpotato rotation experiment in Agoro rice scheme. (credit G. Kyalo)

What is the problem?

In the northern and eastern regions of Uganda, sweetpotato vines completely dry out during the prolonged dry period (December to April). There are no vines for timely planting, and most farmers plant less than they would like to. Traditional vine sources cannot provide timely, clean and adequate planting material resulting in delayed planting and consequently poor yields. Therefore, farmers source for vines from as far as central Uganda, 700 km away.
However, in northern Uganda, there are irrigation schemes and lowland rain fed rice production systems where rice is grown during the first season, and the land left under fallow until the next planting the following year. During the fallow periods, there is prolific re-growth of mixed weeds and shrubs which contribute to grazing pastures during the dry season. However, hard pans develop making land preparation for the next rice planting tedious and costly. Instead, the fallow could be used for sweetpotato production. Rice-sweetpotato rotation is not commonly practiced in Uganda, and its benefits have not been properly researched and documented.

What do we want to achieve?

Research on the sweetpotato-rice rotation aims to: (i) investigate the influence of sweetpotato -rice seed crop rotation on the purity of the rice seed[1], and pest and disease prevalence; (ii) assess the influence of crop rotation on rice seed and sweetpotato vine and root yield and, (iii) evaluate the cost-benefit of the different rotation options (sweetpotato-rice, rice-rice, sweetpotato-sweetpotato) to provide basic sweetpotato seed in a timely manner to decentralized multipliers in the sweetpotato seed value chain.

Where are we working?

We are working in the Agoro Irrigation Scheme, Lamwo district in northern Uganda. There are other irrigation schemes in northern and north eastern Uganda, where farmers could benefit if the innovation is successful.

How have we made it happen?

We set up rice-sweetpotato seed rotation validation trials in December 2015 and three rounds of trials have since been planted and harvested. The trials aimed at testing the rice-sweetpotato-rice, sweetpotato-rice-sweetpotato, rice-rice-rice, and sweetpotato-sweetpotato-sweetpotato

1 If there is no break crop, volunteer rice seed from the previous crop will mix into the current crop.

CIP INTERNATIONAL POTATO CENTER A CGIAR RESEARCH CENTER

NaCRRI NATIONAL CROPS RESOURCES RESEARCH INSTITUTE

Partners:

National Crops Resources Research Institute (NaCRRI), Uganda
BioCrops (U) Ltd.

Fig. 2 Rice Rotation Plot at Tillering stage (credit NaCCRI Rice Team)

treatments using a Randomised Complete Block Design (RCBD) with four replicates. Clean sweetpotato cuttings of three varieties: Ejumula (orange-fleshed), NASPOT 10 O (also known as Kabode, orange-fleshed) and NASPOT 11 (cream-fleshed) sourced from BioCrops Uganda Ltd, and three rice varieties (New WITA 9, Komboka and Agoro) were used for the study. The crop was gravity-flow irrigated twice a week for 30-60 minutes during dry periods. The rotation crop was planted immediately after each harvesting. Data were collected on incidence and severity of diseases, pest infestation, plant vigour, root and vine weight at harvest, number of productive tillers, grain yield and rice biomass dry weight at harvest. Financial data to assess the cost-benefit ratios of the sweetpotato-rice rotation was also collected.

Who are we working with?

We are working with the Cereals Program of the National Crops Resources Research Institute (NaCRRI) of the National Agricultural Research Organization (NARO).

What have we achieved so far?

Results from the first round of sweetpotato-rice rotation show that sweetpotato yields in the rotation (32.6 t ha-1) are significantly higher than those in the control (25.1 t ha-1). Likewise, the yield of rice was significantly higher in the rotation (5.3 t ha-1) compared to the control (4.3 t ha-1). This means that farmers who practice rotation will harvest more compared to those who plant rice after rice. However, the off-season sweetpotato crops recorded high weevil infestations with scores as high as 6.3 (for NASPOT 10 O), for both rotation and control plots. This represents about 60% weevil infestation of harvested roots and calls for better agronomic practice (more irrigation and hilling-up, in particular) to manage weevil infestation. The severity and incidence of sweetpotato virus disease complex and Alternaria blight were not significantly different between rotation and control plots.

The results show that the estimated net profit ratio from the rotated crop was 2.0, compared to 1.8 for the control, which is statistically significant (Table 1). The high net profit ratio in the rotation is due to less labour cost for land preparation when rice is planted after sweetpotato. The better yield of rice in the rotation could be related to easy water percolation in the rotation plots compared to the control. However, dry season planting requires good control of sweetpotato weevil. Sweetpotato-rice rotation is a promising technology which is already being taken up by farmers around the Agoro rice scheme. The rotation ensures: profitable utilization of land because sweetpotato roots and vines can be sold for income; farmers can have vines to plant at the beginning of the planting season; and fields are easy to manage for the next rice crop thereby reducing costs of land preparation.

Table 1: Net Profit Ratio for rotation and control plots (planted in April 2016, harvested in September 2016)

Inter-vention	Treatment			Control		
Rep	Block 1	Block 2 (R-SP-R)	Overall (SP-R-SP)	Block 3 (R-R-R)	Block 4 (SP-SP-SP)	Overall
Rep1	1.7	2.3	2.0	1.3	2.3	1.7
Rep2	1.5	2.9	2.2	1.4	2.2	1.8
Rep3	1.7	2.7	2.2	1.3	2.0	1.7
Rep4	1.7	1.4	1.6	1.4	2.4	1.9
Overall	1.7	2.3	2.0	1.3	2.2	1.8

Source: Field Trial in Agoro Rice Scheme; R = rice; SP = sweetpotato

What next?

The last sweetpotato-rice rotation experiment will be harvested in October 2017, and full analysis undertaken. In Madagascar, rice farmers have long practiced a rice-sweetpotato rotation but literature on the benefits of this system is scanty. We are seeking collaboration with the Fiompiana Fambolena Malagasy Noreziana (FIFAMANOR) Centre de Développement Rural et de Recherche Appliquee, Antsirabe, Madagascar, to continue joint research and out scaling of the rice-sweetpotato rotation systems.

Fig. 3 Signage for Rice Rotation Plot

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