DIVERSify Factsheet no. 12

PRACTICAL EXPERIENCES AND INNOVATION

Knowledge exchange of plant teams: the case of improved fallows in Western Kenya

ABSTRACT

KEFRI led a workshop with farmers and farming practitioners at the beginning of the DIVERSify project within the Lake Victoria Basin Eco-region in western Kenya, East Africa. The overall aim was to **assimilate existing expertise of farmers, agronomists, breeders, and policy makers, and to facilitate knowledge exchange and innovation in plant teams**. More specifically, we aimed to contribute an understanding of current agricultural practices within the region and any perceived or realised barriers to plant team use.

Several technologies and innovations were identified at the workshop, including **improved fallow** plant teams. Improved fallows involve the targeted use of crop species in order to achieve one or more of the aims of natural fallow within a shorter time or in a smaller area. The workshop was followed by demonstration of a trial comprising of an improved fallow system and **maize-bean intercrop**. Below, we outline some of the results and practical recommendations that came out of the workshop and demonstration trial.

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PEDO-CLIMATIC ZONE

Sub-humid

CONTEXT

There is no better place for testing and demonstrating farmer innovations with plant teams than Nyabeda village in Siaya County – located in Kenya's Lake Victoria region. After all, the **predominant crops of maize (Zea mays) and common bean (*Phaseolus vulgaris*)** have been at the heart of various agroforestry technology developments in collaboration with national and international organisations for decades. These technologies encompass traditional farming systems and contemporary solutions. They **commonly integrate legume nitrogen-fixing trees, shrubs or herbaceous species in cropping systems** in order to improve **soil fertility and health** for food production. Many farmers are subsistence farmers in the region and Nyabeda village has a population density of c.320 persons per square kilometre. The average farm size is 1.3 ha per household. **Food security** is therefore a great priority.

IDENTIFYING AND TESTING PLANT TEAMS

Several 'plant team' technologies and innovations were identified during KEFRI's stakeholder workshop, held in early 2018 at KEFRI's Lake Victoria Basin Eco-region Research Programme. These included working with a range of crop species as **improved fallows, biomass transfer or green manure, rotational intercropping and 'push and pull'**. However, a number of barriers were identified that limit the adoption or implementation of these technologies. These included the challenges **of climate change, lack of farm input materials such as inorganic fertilisers, small land size, and weed and pest control complexity**, to name a few. Participants identified the need for research into crop varieties that are resilient to climate change. See DIVERSify Factsheet no. 14 for further discussion of barriers to use of plant teams and potential solutions.

After the workshop, we decided to establish a demonstration of an effective plant team cropping system in Nyabeda Primary School (Siaya County, Western Kenya). The trial was co-designed with the farmers who are familiar with working with improved fallows. Improved fallows involve the planting of fast-growing nitrogen-fixing trees or shrub species as part of a crop-fallow rotation for rapid replenishment of soil fertility. In the trial, we tested the effect of the commonly used **nitrogen-fixing white tephrosia** (*Tephrosia candida*) on yields of a subsequent **maize and common bean** intercrop and in different plant team combinations. We expected that use of the nitrogen-fixing white tephrosia would enhance the productivity of the maize and beans.

Fig. 1 Farmer tending a maize and bean intercrop. Credit: David Odee

The demonstration trial was carried out during the **short rains** between September and December 2018, and the **long rains** between March and July 2019. It consisted of the following design and treatments:

- Monocultures of maize, common bean and tephrosia.
- Mixtures of maize and common bean, maize and tephrosia, tephrosia and common beans, and maize and common beans and tephrosia. **Mixed species treatments were established by planting alternate rows.**
- Other treatments were **Rhizobial inoculation** and **inorganic fertiliser application** at the rate of 120 kg/ha of DAP/NPK, versus no inoculation and fertiliser controls. Bespoke rhizobial inoculants were developed and used in the inoculation of the legumes - white tephrosia and common beans.
- Planting densities were 266,667 plants/ha for common beans, and 61,538 plants/ha for maize and tephrosia.
- After harvesting the short rains crop, white tephrosia foliage and pods was **uniformly spread and incorporated back into their respective plots**, in readiness for maize and common beans planting during the long rains.

Fig. 2 Assessment and processing of maize grain yields with participatory farmers. Credit: Charles Magare

RESULTS AND PRACTICAL RECOMMENDATIONS

The headline results from the trial were:

- The **highest maize grain yield** was 6.3 t/ha grown on **tephrosia improved fallow**, and without inorganic fertiliser. This is **nearly double the average yield** for maize grown with fertilisers in Siaya County.
- The **highest common bean grain yields** of 3.4 t/ha was obtained with common bean grown as a **monocrop** during the short rains. This yield was also above the average common bean yields for the county.
- Use of tephrosia fallow and intercrop **reduced the incidence of the parasitic witchweed** (*Striga hermonthica*) on maize.

The local community were pleased with the trial, including 200kg of maize grain which was harvested from the demonstration trial and gifted to the school feeding programme. The main **practical recommendations** for smallholder farmers working with plant teams that we identified in this case were:

- **Fallow species can be intercropped with maize-bean plant teams** in the first season.
- The above ground biomass (leaves and twigs) can then be cut and incorporated into the topsoil as **green manure** in readiness for the next season; the stems and branches can be used as stakes or firewood.
- Use of plant teams can improve yields, control weeds, and reduce the need for inorganic nitrogen fertiliser, but phosphorus supplementation is important for enhancing biological nitrogen fixation by the legumes.

CONCLUSION

Several agroforestry technologies and farmer plant team innovations were identified as being used by farmers in Western Kenya. These included improved fallows, biomass transfer, rotational intercropping and 'push and pull'. Plant teams are integral to the maize-common bean production system of smallholder farmers in western Kenya. A demonstration trial allowed further knowledge of this system to be developed in collaboration with the local community. Such knowledge exchange plays an important part in overcoming a number of the barriers that practitioners face when working with plant teams.

FURTHER INFO

> Watch this video to learn more about KEFRI's work within the DIVERSify project and plant team cropping systems in Kenya.
> Summaries of other participatory farmer trials as part of the DIVERSify project are available at plant-teams.org.
> Read on to discover more about how farmers are innovating with plant teams and the opportunities that they can offer farm businesses, or the potential solutions to barriers to adoption: DIVERSify Factsheet no. 13 - DIVERSify Factsheet no. 14

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