Push and Pull Systems

CCARDESA
Centre for Coordination of Agricultural Research and Development for Southern Africa

Technical Brief 58

A push pull system is a technique that repels parasitic plants and pests that attach themselves to the crop roots and feed on them.. In push-pull, a cereal crop is intercropped with a leguminous plant like desmodium or molasses grass, while a popular fodder crop, Napier grass, is planted as a border around the field. Desmodium produces volatile chemicals that attract predators of the cereal e.g of maize pests. More importantly, by giving a false distress signal to the moths that the area is already infested, these chemicals 'push' the egg laying moths away from the crop to seek out habitats where their larvae will face less competition for food. Napier grass also produces volatile chemicals that 'pull' the moths towards them, and then exudes a sticky substance that traps the stem borer larvae as they feed. Few larvae survive. Napier grass attracts stem borer predators. The intercropping is a climate smart practice as it mitigates emission of Greenhouse gases through the reduced need for pesticides. The push-pull system improves food security and boosts farm income.

MOST SUITABLE AGRO-ECOLOGICAL CONDITIONS

Value chain

- Maize
- Sorghum
- Rice
- Livestock
- Other

Soil texture

- Light
- Medium
- Heavy

Climatic zone

- Arid
- Semi-arid
- Sub-humid
- Humid

Water source

- Rainfed
- Partly irrigated
- Irrigated

Annual average rainfall (mm)

- < 250
- 250 - 500
- 500 - 750
- 750 - 1000
- 1000 - 1500
- > 1500

Topography

- Flat to gentle slope (0 – 5 %)
- Moderate to rolling slope (6 – 15 %)
- Hilly slope (16 – 30 %)
- Steep slope (> 30 %)

MOST APPROPRIATE CONDITIONS AND REQUIRED INPUTS

Farming system

Does it require collective action

- Yes
- **No**

Characteristics

- Subsistence
- Commercial Small
- Commercial Medium
- Commercial Large

Farm size (ha)

- < 2
- 2 to 5
- 5 to 10
- > 10

Mechanisation

- Manual
- Animal
- Mechanised

Human resources

Labour intensity – level of effort

- Low (household)
- Medium (seasonal)
- High (outside labour)

Gender/youth smart (low investment/low labour requirements)

- Yes
- No

Financial resources

Initial investment

- Low
- Medium
- High

Maintenance Costs

- Low
- Medium
- High

Access to finance capital or credit required

- Yes
- No

Enabling Environment

Extension support

- Yes
- No

Access to inputs

- Yes
- No

Market access

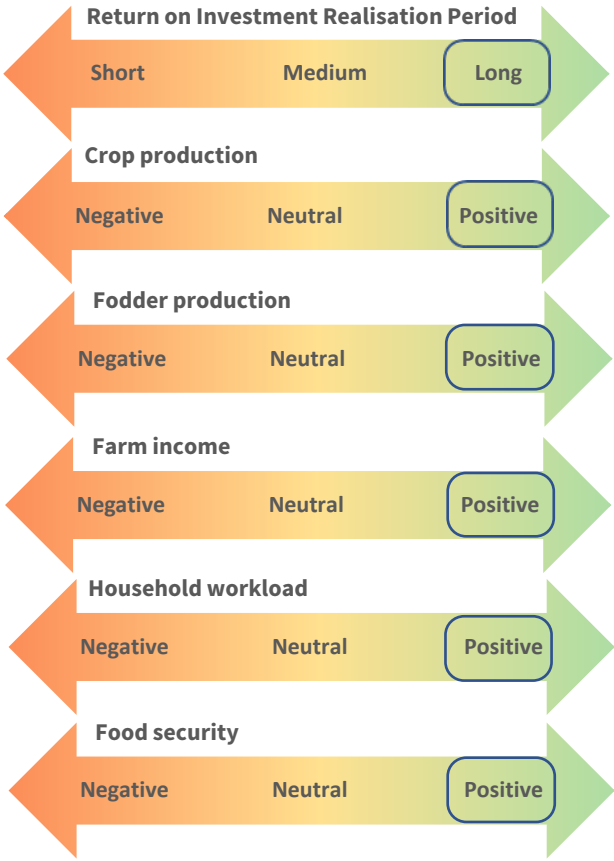
- Yes
- No

The purpose of this technical brief is to guide where this **practice, technology or strategy** could be applied. It may be applicable in other circumstances, but this brief focuses on where it is possibly **most suitable**. Content is general, and should be contextualised depending upon locality. The brief provides an overview, details of appropriate agroecological characteristics, appropriate conditions and inputs, possible outcomes and impacts, how the **practice, technology or strategy** should be applied, potential benefits and drawbacks, and provides suggestions for further reading in terms of CCARDESA materials and other sources, including those used to develop this technical brief.

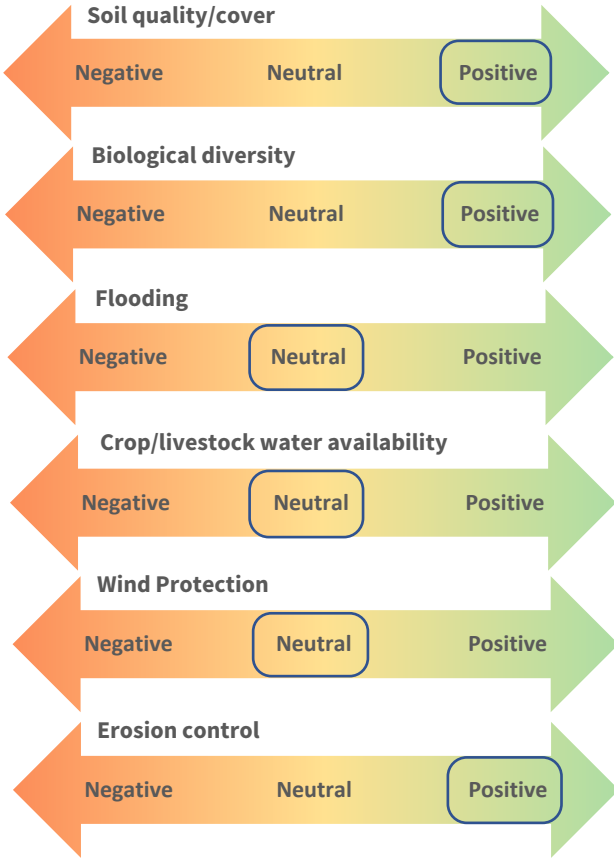
*CCARDESA is a subsidiary of SADC, coordinating and harmonising agricultural research and development in Southern Africa. This **Technical Brief** is part of a series of materials designed to support **Knowledge Products on climate smart agriculture** available here: www.ccardesa.org/saaiks-knowledge-hub*

POSSIBLE IMPACT/OUTCOMES

Socio-Economic Impacts Positive or Negative



Ecological Impacts Positive or Negative



These descriptors indicate whether the practice, technology or strategy has a positive, neutral , or negative impact or outcome
Those with no box are deemed not-applicable

TECHNICAL APPLICATION

To effectively implement push and pull systems:

- **Step 1:** Plant Napier and a legume like Desmodium or molasses grass between every three rows of maize/sorghum as barriers to repel stemborers away from crops.
- **Step 2:** Plant the Desmodium first as soon as the rains begin, so it immediately repels the stalk borers before the maize/sorghum emerge.
- **Step 3:** Plant three rows of Naiper grass around the borders of maize field.
- **Step 4:** Allow pest enemies such as ants and spiders to enter the field to feed on stemborers.
- **Step 5:** Cut grass and fed to animals as forage.
- **Step 6:** Abandon areas that are heavily affected by stemborers until treated.

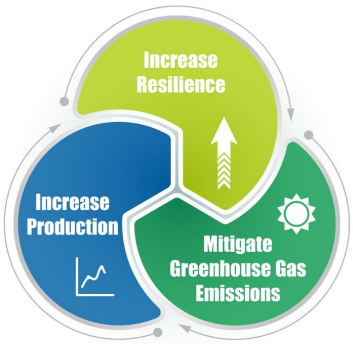
CLIMATE SMART AGRICULTURE OUTCOME(S)

Reflecting how this **practice, technology or strategy** contributes to Climate Smart Agriculture outcomes

A push-pull system supports sustainable productivity by reducing the need for expensive pesticides, and boosting farm income.

A sustainable and environmentally friendly method for maintaining soil health and productivity while controlling pests.

Reduced application of synthetic fertilisers reduces greenhouse gas emissions.



SUMMARY/KEY ISSUES

Benefits

- Reduces the need for pesticides.
- Improves food security and boost farmers' income.
- The green technique deals with trapping the pests (pull) and repelling them (push) by planting Napier and desmodium or molasses grass next to cereal crops.
- The relationship between insect-plant and insect-insect (introducing pest enemies such as ants/spiders) is achieved in order to kill stemborers.
- Grass planted next to crops can be salvaged and used as forage.

Drawbacks

- Naiper grass take up space on the field.
- Cost and lack of availability of Desmodium seed.
- Difficulty in establishing the Desmodium crop, hence practice not suitable for all farmers.

REFERENCE MATERIAL

CCARDESA Related Content

- CCARDESA 2019. KP19 Climate Smart Pest and Disease Control for Maize and Sorghum. Centre for Coordination of Agricultural Research and Development in Southern Africa, Gaborone, Botswana
- CCARDESA 2019. KP20 Climate Smart Pest and Disease Control in Rice. Centre for Coordination of Agricultural Research and Development in Southern Africa, Gaborone, Botswana
- CCARDESA 2019. Technical Brief 07 Inter-cropping. Centre for Coordination of Agricultural Research and Development in Southern Africa, Gaborone, Botswana.
- CCARDESA 2019. Technical Brief 20. Crop Variety. Centre for Coordination of Agricultural Research and Development in Southern Africa, Gaborone, Botswana.

Additional Information

- FAO 2017. PRACTICE BRIEF Climate-smart agriculture Climate-Smart Pest Management: Implementation guidance for policymakers and investors. Rome, Italy.
- The Food and Agriculture Organisation (FAO), 2015. 'Push-Pull' fights pests, boosts milk production. Rome, Italy.
- The Food and Agriculture Organisation (FAO), 2002. Land and Agriculture. Rome, Italy.
- The Food and Agriculture Organisation (FAO), 2018. Integrated management of the Fall Armyworm on maize. Rome, Italy.
- Pickett, John & Woodcock, Christine & Midega, Charles & Khan, Zeyaur. (2014). Push-pull farming systems. Current opinion in biotechnology. 26C. 125-132. 10.1016/j.copbio.2013.12.006.
- Push-Pull 2017. Climate-Smart Push-Pull Technology for Food Security, Safety and Environmental Sustainability African Insect Science for Food and Health.

Citation: CCARDESA and GIZ 2019. Technical Brief 58. Push and Pull Systems. CCARDESA Secretariat, Gaborone, Botswana.