APSIM simulation inputs for staple crop production in the Southern African Development Community (SADC) region of southern Africa plus Kenya

The Agricultural Production Systems Simulator (APSIM) is highly advanced software with a suite of modules that simulate the production of plants a under a variety of soil, climate and management interactions. It requires an informed set of inputs to provide predicted yields for particular crops. For staple crops of the southern African region we used the following information to inform our choice of inputs for each simulation.

Maize production

- The main growing season for rain-fed farming is from October to March.
- Planting can take place from late October to mid-December (Smith, 2006; du Plesis, 2003). In the model a sowing window from 20 October to 15 December was fixed with sowing set to take place at the first opportunity when 20mm of rain had accumulated in five consecutive days (Duffy and Masere, 2015).
- Early, medium and late maize cultivars reach maturity in 115-130days, 130-145days and 140 -150 days respectively (Smith, 2006). Representative cultivars for early, medium and late were selected from those available in APSIM.
- As long as sowing density is within a fairly broad range (3 – 9 plants per square metre) this has little effect on yields (Masere and Duffy, 2014). In the model sowing density was fixed at 4.75 plants/square metre.
- Row width can range from 0.7m to 2.3m, in-row spacing can range from 12cm to 44cm (du Plesis, 2003)
- Planting depth of maize varies from 5 to 10 cm, depending on the soil type and planting date. As a rule, planting should be shallower in heavier soils than in sandy soils (Smith, 2006; du Plesis, 2003).
- Optimal weeding can be achieved by conduct weeding operation 2-3 times (Makuvaro *et al.*, 2014; Masere and Duffy, 2014). In the model a maximum of three in-crop weeding times were fixed.
- Five fertiliser application rates (5kgN, 20kgN, 30kgN, 40kgN and 50kgN/ha) simulated were chosen based on what small-scale farmers could afford and may be willing to invest in. The fertilizer application was split, with 40% applied at sowing and 70% applied as top dressing within 35 days after sowing.

Sorghum production

- Planting can take place from late October to mid-December (Smith, 2006, DAFF, 2010).

- Planting depth should be between 25 to 50mm depending on the texture of soil (Smith, 2006, Du Plesis, 2008).
- Spacing: 900mm x 50-150mm (Smith, 2006; Du Plesis, 2008).
- Early cultivar usually takes 94-110 days to mature, medium (105 -115 days) while late cultivars takes more than 118 days (Smith, 2006). Representative cultivars for early, medium and late were selected from those available in APSIM.
- Weeding should be thorough (Smith, 2006; Du Plesis, 2008). In the model a maximum of three in-crop, weeding times were set.
- Five fertiliser application rates (10kgN, 20kgN, 30kgN, 40kgN and 50kgN/ha) simulated were chosen based on what small-scale farmers could afford and may be willing to invest in. The fertilizer application was split, with 30% applied at sowing and 70% applied as top dressing within 35 days after sowing.

Soybean production

- Planting can take place from mid-October to mid-December (Smith, 2006).
- Sowing depth range from 25-40mm (Smith, 2006).
- Plant population can range from 200 000 plants/ha to 400 000 plants/ha depending on climate conditions (Smith, 2006; DAFF, 2010).
- Row spacing range from 400-900mm, while in-row spacing range from 50 to 150mm (DAFF, 2011).
- The duration from planting to maturity should be approximately 120 to 130 days for a well-adapted medium cultivar (DAFF, 2010). Four cultivars in APSIM representative of very early, early, medium and late maturing are simulated.
- Weeding operations to be conducted as is necessary (Smith, 2006). In the model a maximum of four in-crop, weeding times were set.

Bean production

- Planting depth range from 30mm to 50mm based on texture of the soil, light textured soils (50mm) and about 30mm for heavy textured soils (Smith, 2006).
- Cultivars can be selected based on weather conditions of an area. Early cultivar usually takes 85-94 days to mature, medium (95 -104 days) while late cultivars takes 105-115 days (Lienbenberg, 2009). Representative cultivars for early, medium and late were selected from those available in APSIM.
- Planting can take place between mid-November to mid-January (Smith, 2006; Windmill Farming, 2014).

- Plant spacing = 50mm X 900mm which gives approximately 23plants/m2 (Windmill Farming, 2014)
- Early weed control is important because beans is a low-growing plant that struggles to compete for nutrients and water against overshadowing weeds (Windmill Farming, 2014). In the model a maximum of four in-crop, weeding times were set.

Cowpea production

- Planting starts from mid-November to mid-December (Madamba, 2002; Smith, 2006).
- Sowing depth must be less than 50mm (Smith, 2006; DAFF, 2011).
- Row spacing range from 450mm – 750mm, in-row spacing can range from 100mm to 20mm (Madamba, 2002; Smith, 2006; DAFF, 2011). Plant population ranges from 150 000 to 300 000plants/ha (Madamba, 2002; Smith, 2006; DAFF, 2011).
- Weeding to be done within four weeks after planting. Thereafter weed as is necessary (Madamba, 2002). In the model, maximum of four in-crop weeding times were set. The maximum days to weed after emergence was set to 28 days.
- According to DAFF (2011) early maturing takes less than 100 days to mature, medium cultivar takes between 100 and 120 days while late maturing cultivars take more than 120 days.
- Cultivars that are representative of early, medium and late maturity were selected in the model.

NB: The same crop management operations for Southern African countries apply for Kenya and Mauritius with the only difference is that the main growing seasons for Kenya and Mauritius are March to August and February to July respectively.

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