ANNUAL PROGRESS REPORT 2012/13

ISCM PROJECT ON

"MODELLING WORLD-WIDE GXE INTERACTION"

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1. General

The goal of the project is to gain a better understanding of the physiological mechanisms underlying the genetic variation in crop response to environmental factors by monitoring key plant processes contributing to yield and quality in a common set of diverse cultivars grown in diverse environments from around the world. Specific objectives are to:

- measure canopy development, radiation interception, water use, water stress sensitivity and, biomass accumulation and partitioning for a number of diverse cultivars (from different countries) in diverse environments (in different countries),
- determine model trait parameters (genetic coefficients) for each cultivar, derived from development, growth and water use measurements,
- identify and formulate underlying mechanisms of genotype response to environmental factors, and
- evaluate models' ability to simulate genotypic differences in crop performance.

The following organizations are participating in the project: SASRI, ZSAES, SIRC, and CIRAD and the following cultivars will be used in the trials: N41, R570, CP88-1762, HoCP96-540 and ZN7. In some cases NCo376 and Q183 will also be planted. The main activities in the project so far have been to generate and distribute genetically-true, disease-free seed material of the relevant cultivars to each of the participating countries and to propagate for the experiments that are scheduled to be planted in 2013 and 2014.

2. Progress in South Africa

Hardened tissue cultured plants from seven varieties (ZN7, NCo376, N41, Q183, CP88-1762, HoCP96-540, R570) were planted on 7 March 2012 at the SASRI research station at Pongola. These plants were grown until March 2013 and then harvested. Final counts and stalk heights of each variety are presented in Table 1. Seedcane from each variety was replanted in seven 120 m rows (see Figure 1). Each row was fertilized with 100 kg/ha of MAP (12 March 2013) and sprayed with pre-emergence herbicides (13 March 2013). All varieties have emerged since planting (see Figure 2) and are being monitored monthly for stalk population and stalk height in 5 m sections. For the next 12 months (until March 2014), sugarcane varieties will be bulked until the experimental phase begins in March 2014.

Table 1: Number of stalks harvested and stalk height of seven cultivars (from approx. 50 tissue culture plants) grown in Pongola from March 2012 – March 2013

Variety	Number of stalks harvested	Mean Stalk Height (cm)
Q183	205	185
NCo376	482	205
HoCP 96-540	289	192
N41	384	209
R570	378	199
CP 88-1762	347	192
ZN7	359	179

Other activities that need to be completed in 2013 are the training of technical staff to do crop measurements and use instruments (ceptometer and SPAD meter), describing the trial site soil and analyzing its chemical and physical status in order to generate model input data, and the creation of templates for data collection and storage.

Figure 1: Harvesting and replanting operations in Pongola on 12 March 2013

Figure 2: Emergence of all seven varieties in Pongola on 01 May 2013

3. Progress in Reunion

Cultivars R570, Q183 and CP88-1762 have been replanted in November 2012 for the 2nd bulking phase. It will be harvested and replanted in November 2013. Cultivar N41 has been received in 2012 in Reunion from Montpellier Quarantine, and planted for bulking in November 2012. Unfortunately, due to cyclones and very heavy rains, one-eyed sets of N41 have failed to install and many plants died. N41 will therefore have to be bulked-up again as soon as we have received enough setts from eRcane. We are still awaiting setts of HoCP96 from Montpellier Quarantine. The target data of planting the trail remains October 2014. Cultivars R570, Q183 and CP88-1762 will be ready for planting, while there is a strong possibility that N41 would also be ready, while the availability of HoCP96 is unknown at this point in time.

4. Progress in Zimbabwe

Hardened tissue cultured plants from six varieties (ZN7, N41, Q183, CP88-1762, HoCP96-540, and R570) were planted into the field on 15 December 2011 at the ZSAES. The varieties were harvested and planted out on 2 November 2012 for further bulking to produce the amount of seedcane required for planting out the trials in 2013. The seedcane passed through the peak growth period and will be ready for use in planting out the trial in June 2013. The scheduled date for planting however is 15 July 2013 (refer to photos and growth parameters below).

Table 2. Number and height of stalks of the six cultivars as of 28 May 2013. The varieties are in the last stage of bulking up and will be planted out in the trial in Mid July 2013.

Variety	Number of stalks	Mean Stalk Height (m)
ZN7	3915	2.18
CP 88-1762	5531	2.12
R570	3330	2.19
Q183	3555	1.76
N41	7993	2.25
HoCP 96-540	5484	2.24

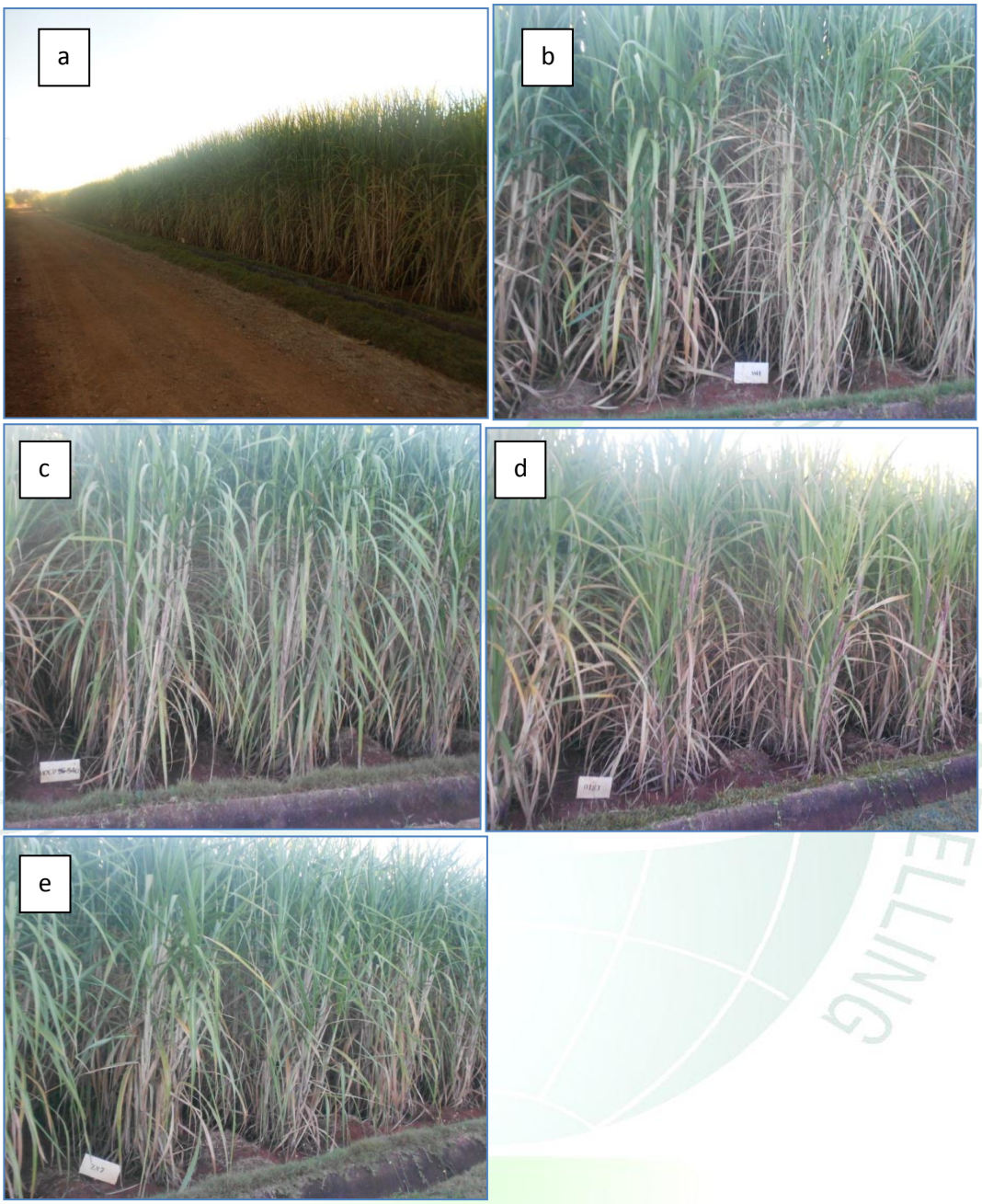

Figure 3. All varieties planted for further re-bulking (a), and varieties R570 (left in b) and N41 (right in b), HoCP96-540 (c); Q183 (d) and ZN7 (e).

5. Progress in U.S.A

The following clones were planted in 4-row 10 meter plots in the fall of 2012: R570, CP80-1743, CP72-2086, N41, N39, NCo376, CP88-1762, N29, HoCP96-540, Q183 and CP 89-2143. ZN7 has been received by US quarantine (APHIS) and is undergoing final testing and should be released to Canal Point the summer of 2013. Because of this delay ZN7 will not be included in the first planting of the test and will be included as soon as sufficient seedcane is available.

Technical staff are working out details for following the agreed upon protocols for the experiment. One present issue is several of the clones are susceptible to either brown rust or orange rust. Both diseases are fairly intense this year and efforts to control the disease using fungicides is not totally successful. This is an unusual year for both diseases in terms of intensity. Hopefully this will not be a major factor next year when the test begins in earnest.

6. Conclusion

Seedcane propagation is mostly proceeding well as planned. Two varieties (ZN7 in USA and HoCP96 in Reunion) may not be included in the first trials due to delays in distribution and and quarantine procedures. Target dates for the planting of the first trial are as follows: ZSAES – July 2013; SASRI – March 2014; SIRC and CIRAD – October 2014. Other activities planned for 2013 is the formulation of data collection and storage templates and technical training in measurement techniques data collection procedures.