P 6.03 - Association between aflatoxin contamination and N_2 fixation in peanut under drought conditions

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Drought tolerance may serve as an indirect selection for resistance to aflatoxin contamination. Symbiotic nitrogen fixation under drought conditions may be one important mechanism for drought tolerance of peanut. Therefore, nitrogen fixation and its related traits may be used as indirect selection of aflatoxin resistance. The aim of this study was to investigate the relationship between N_2 fixation traits and aflatoxin contamination under different drought stress conditions. Two field experiments (during 2003/2004 and 2004/2005 dry seasons) were conducted in a split plot design with three water regimes (field capacity (FC), 2/3 available water (AW) and 1/3 AW) as main plot, and 11 peanut genotypes as sub-plot treatments. Data were observed on kernel infection by *Aspergillus flavus*, aflatoxin contamination, total nitrogen content, N_2 fixation and its related traits viz. nodule number, nodule dry weight and nitrogenese activity (acetylene reduction assay; ARA). All parameters in this study varied depending on water regimes and genotypes. Amount of water transpiration had a positive significant influence on total nitrogen content and N_2 fixation (r = 0.94** and 0.95**). On the other hand, total nitrogen content and N_2 fixation were negative significant influence on kernel infection and aflatoxin contamination (r = -0.28* to -0.45**) across water regimes. The relationship were also found between nodule number, nodule dry weight and ARA with kernel infection and aflatoxin contamination (r = -0.14 to -0.60**) across water regimes. There were negative relationships between kernel infection and aflatoxin contamination with nitrogen content and N_2 fixation in the whole plant and shoot under drought conditions (r = -0.26 to -0.67**). However, such relationship were positive relationships with nitrogen content and N_2 fixation in seed and partitioning to seed (r = 0.22 to 0.54**). Moreover, There were negative relationships between kernel infection and aflatoxin contamination with nodule dry weight and ARA (r = -0.43* to -0.86**) under drought conditions. The observations indicated that genotype selected for high nitrogen content or N_2 fixation and its related traits may also exhibit better aflatoxin resistance. Because measurement for nodule dry weight was simple, it may be practical for application in breeding programs.

P 6.04 - High throughput phenotyping method for water use efficiency in rice under field conditions

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A collaborative CIAT/Cirad project aims to create new improved upland rice germplasm for drought tolerance based on population improvement through recurrent selection (RS). In the framework of a multidisciplinary team (ecophysiology, molecular genetics and breeding), we seek to enhance this breeding strategy through the integration of marker-assisted breeding tools. This requires improving methods for high throughput phenotyping in the field.

Four hundreds lines selected from diverse recurrent populations were screened under drought conditions in Villavicencio CIAT experimental station (Colombia) during the dry season 2008/2009. Drought stress was applied for two weeks at panicle initiation stage. Drought response under water deficit at flowering stage was evaluated based on soil moisture and canopy temperature at flowering with an infra-red thermographic camera and final grain yield.

Leaf temperature at/around flowering stage exhibited strongly significant varietal differences that were negatively correlated with soil moisture content and yield. This phenotyping approach permitted identifying genotypes that display good maintenance of transpiration (and thus sustained growth) under drought stress, related mainly to limited water extraction and/or greater root depth; it also enabled identifying genotypes that have high transpiration

rates (and thus higher potential growth rates) under irrigated control conditions. Selecting suitable combinations of both characteristics is expected to help identifying drought tolerant material with high yield potential.
The methodology will be further improved by (1) including on each thermographic photo a wet/dry object to normalize canopy temperatures against weather fluctuations for situations where micro-meteorological backup is not available, and (2) sampling leaf material for complementary delta $_{13}C$ measurements indicative of transpiration efficiency (TE).
The integrated methodology is being implemented in RS breeding schemes and in parallel in a genetic association study on a japonica rice variety panel, in order to identify promising genomic regions and polymorphisms for marker development. This will eventually permit developing efficient marker-assisted recurrent selection (MARS) approaches.

P 6.05 - Participatory varietal selection helps in identification and release of high yielding rice variety suitable for drought prone rainfed ecosystem in Tamil Nadu, India

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Scientists-led, formal plant breeding programs (FPB) have been highly effective in producing input-responsive, broadly adapted cultivars of annual grain crops. However, the products of FPBs have not been widely adopted by resource-poor farmers in marginal environments. Participatory approaches in which farmers also share responsibility in the development or evaluation of cultivars are more likely to produce varieties acceptable to farmers in marginal environments. Participatory varietal selection (PVS) is one such scheme wherein farmers evaluate finished varieties on-station or test them in their fields under their own management practices. PVS programs were shown to be successful in developing rice cultivars suitable for rainfed environments. PM 01 011 (PMK 4), is an high yielding rice suitable for drought prone rainfed environments that has been identified through PVS and released recently in Tamil Nadu state, India. The culture, PM 01 011 was selected from IET 16704 (Pantdhan 10 x IET 9911) in 2001 and further evaluated through PVS for potential yield, drought resistance and superior grain quality involving farmers in Ramnad and Sivagangai, two major rainfed districts of Tamil Nadu, India. It is semi dwarf (100-110 cm), erect, non-lodging and early maturing (100-105d). In 'on station' trials conducted for six years continuously, the culture gave a mean yield of 3181 kg/ha, 15.3% higher over check under rainfed conditions. In over 156 on farm and adaptive research trials, the culture gave an average yield of 3740 kg/ha, 14.7% increase over the check. The culture also gave higher yields under irrigated conditions and is fertilizer responsive. Besides yield, the culture was highly preferred by farmers for its long slender white grains with good cooking qualities, early maturity (by 7-10 d), medium plant height, non-lodging habit and ability to withstand water inundation for shorter periods. It fetches higher price in the market than the check, PMK 3 and land races. PVS is thus overcomes the inefficacy in formal breeding in developing varieties that do not meet farmers' requirements, particularly in marginal environments. PVS thus enabled in identifying and release of this high yielding rice suitable for drought prone rainfed districts and we expect the PVS scheme will facilitate its rapid and wider adoption as well.

P 6.06 - Enhancing cotton production coping with drought: insights from marker assisted selection

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Genetic improvement of cotton (*Gossypium* spp.,) under water limited environments is considered as an important breeding goal since more than 70% of Indian cotton cultivation experiences water stress which rigorously affects