The Utilization of Stored Soil Moistures for Forage Legumes Supply in the Dry Season in West Timor, Indonesia

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Introduction Subsistence cattle production and maize cultivation are the main agricultural activities of farmer in West Timor , Indonesia .Maize yields tend to be low and inconsistent due to low agricultural input levels ,poor crop nutrition and management and climate variability .Whilst the average annual rainfall (which falls between December and April) is 1500 mm per annum ,it is highly variable and uneven in its distribution .During the dry season (April-November) fodder supply becomes increasingly difficult to source and of a lower quality as the dry season progresses resulting in a decline in animal liveweight .

Maize as a staple food is grown without inorganic fertilizer inputs with production risk usually addressed through the growing of larger areas in preference to investment in intensive cultivation and costly fertilisers .However ,pressure on land resources is increasing and the soil fertility status is declining which is forcing farmer to practice shifting cultivation to maintain production . Relay cropping of high-biomass forage legumes during the late wet season (February sowing) ,when water and nutrient requirement by maize is declining ,has potential to supply quality forage for livestock production and to improve soil nutrient availability through mineralization for the following maize crop .

Materials and methods Research on stored soil moisture utilization and nitrate nitrogen contribution by the legumes has been undertaken to determine the potential for growing forage legumes under either a relay cropping system or as part of the maize rotation .Eight shrub legumes species *Centrosema pascuorum* ,*Clitoria ternatea* ,*Dolichos lablab* ,*Desmanthus pernambucanus* , *Desmanthus virgatus* ,*Macroptilium bracteatum* ,*Stylosanthes guianensis* and *Stylosanthes seabrana* were evaluated for species adaptation and nitrogen contribution when sown in February as rainfall started to decline at the end of the wet season .The shrub-legumes were grown in five sites across West Timor Island (Sillu ,Biloto ,Usapinonot ,Kletek and Kakaniuk) representing spatial distribution in altitude (5-600 m asl) ,soil types (vertisol and alfisol) and rainfall (uni-and bi-modal ; 1000-1500 mm) .

Results and discussion The study showed that at sowing of the legumes in February ,when the maize crop is maturing ,there was in fact a full profile of soil water (approx .200 mm plant available water) stored for late wet/early dry season fodder production , as well as additional contribution from between February and the end of the wet season in April .

Soil moisture at legume flowering (40-70 days after sowing-DAS) showed that between 20 and 50 mm of stored water had been utilised by the crop and by 200 DAS (August-September) soil moisture remaining depended greatly on soil type and legume grown .

On the vertisol soils which are able to hold larger amounts of soil moisture (210 mm plant available water capacity-PAWC) , biomass production from the shrub legumes was greater than on the alfisol (155 mm PAWC) .Biomass production of between 2-6 t DM/ha was achieved over 200 days on the vertisol ,compared to an average of 1 t DM/ha when grown on the alfisol soils .*C . pascuorum* ,*C .ternatea* and *D .lablab* were the most promising legumes yielding up to 4 t DM/ha between February and August ,whereas *S .guianensis* and *S .seabrana* , which were slow in establishing ,produced up to 6 t DM/ha by the late dry season (October-November) .

Early data suggests that the nitrate nitrogen contribution from the legumes was between 5-38 kg N/ha with *M .bracteatum* ,*D . pernambucanus and C .pascuorum* contributing 38 ,28 and 30 kg N/ha ,respectively .This is equivalent to the application of between 60 and 80 kg/ha of Urea .The value of the fixed nitrogen to future maize production is yet to be fully assessed ,however it is expected that it will provide a positive contribution to maize yields which currently stand at an average of 1 .5 t/ha for West Timor .

This present study indicates that there is potential for integrating forage legumes into the current maize based cropping systems without detrimental effects on current production .The challenge now is to work with the farming community to see these opportunities fulfilled .