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An Agroclimatic Characterisation of the Growing Season for Improved Rainfed Maize Productivity in Zimbabwe

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Abstract

In Zimbabwe, the unreliability of the onset of effective rainfall poses the greatest challenge to the viability of the rainfed maize production in Zimbabwe. In this paper, the optimal maize cropping period was determined to optimize water use under pure rainfed conditions. For the whole growing season, daily relative response to weather and soil moisture conditions was determined based on relative transpiration simulations, determined with the help of BUDGET model. Long-term rainfall data was first tested for homogeneity using the Gumbel distribution model. The hypothesis of homogeneity of annual rainfall data was rejected (at 1, 5 and 10% levels of significance) in agro-ecological regions I, IIb and V. Based on atmospheric evaporative demand and the germination time for maize in Zimbabwe, the yearly onset dates of effective rainfall were determined. The dates were classified as early, normal and late planting dates, based on 0.8, 0.5 and 0.2 probabilities of exceedance, respectively. It was noted that early-planted crops would be exposed to water stress periods of two up to three weeks between ends of October and mid-November, while the normal- and late-planted crops would experience water stress periods of up to two weeks between mid-February and mid-March. Higher chances of prolonged periods of water stress were noted for early and late-planted maize in all regions. Although late planting would significantly reduce the risks of early in-season dry spells, the length of the growing season would be significantly reduced that medium and long-seasoned crop varieties would not reach maturity. Also, the rejection of the hypothesis for homogeneity of rainfall data could be an indication that agro-climatic conditions that were used to develop the current operational agro-ecological map had changed since 1961 when the current was developed. Consequently, this paper recommends re-agro-ecological zoning in Zimbabwe.

Land Ownership and Range Resources Management in Zimbabwe: A Historical Review

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Abstracts

Land ownership and range resources management and utilisation in Zimbabwe spans over three distinct historical times. In pre-colonial Zimbabwe, chiefs together with their aides and subordinates were custodians of land and its encampment resources. Low livestock and human populations then, coupled with a cultural common sense of purpose within communities created a framework for a kind of “common property resource management” that led to sustainable range resource utilisation. The colonial era through the Land Apportionment Act of 1930, Native Land Husbandry Act of 1951 and the Land Tenure Act of 1969 saw the emergence of Tribal Trust Lands located in fragile environs of agro-ecological zones IV to V that became home to black Zimbabweans who had been dispossessed of resource-rich lands of agro-ecological zones I to III by the settler whites. Sustainable range resource utilisation initiatives such as the construction of mechanical conservation works, demarcation of arable from grazing land and grazing schemes in the Tribal Trust Lands failed partly due to resistance by the indigenous communities and the increases in both human and livestock populations that led to fragmentation of arable plots and subsequent encroachment into grazing lands. Independence brought with it rural development programmes and legislative changes aimed at stemming range resource degradation as well as bringing equity in land ownership among different races in Zimbabwe. Having “purportedly” failed to access enough land for resettlement via the “willing-buyer willing-seller” concept as stated during the Lancaster House Conference of 1979, the Government of Zimbabwe embarked on the Land Reform Programme that degenerated in the Fast Track Land Reform Programme whereby white-owned commercial farms were occupied without any prior logistical and infrastructural arrangements for the incoming settlers. The Fast Land Reform Programme has somewhat managed to ‘avail prime pieces of land’ to hitherto disadvantaged black Zimbabweans. However the

programme presents both threats and opportunities to sustainable range resources utilisation in rural Zimbabwe. A dire need exists for Government to create awareness, educate, enforce and police, through its line ministries, all resettled Zimbabweans to utilise land and its resources in a sustainable manner.

Nitrogen mineralization from fresh and composted animal manures applied to a sandy soil

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Abstract

Animal manure plays a central role as a nutrient source in the smallholder farming systems of Zimbabwe. A laboratory incubation study was conducted to determine the N release pattern from fresh and composted animal manures applied to a sandy soil. There was limited N mineralisation (up to 14.5 mg N kg⁻¹) from the unamended soil due to the low organic matter status of the soil. All the manures contained relatively high mineral N concentrations (0.03 - 0.22 % of total N) before incubation and this readily available N is important for early plant growth. Fresh dairy manure induced net N immobilisation after 14d and mineral N after 80d was only 21 mg N kg⁻¹. Although mineral N from the goat, pig and chicken manures was significantly (P<0.05) higher than unamended control, there were periods of N immobilisation, which lasted 11 - 50d. Composted manures induced net N mineralisation throughout the incubation period and after 80d mineral N was 136%, 149% (40 days), 316% and 355% higher in composted than fresh manures of goat, pig, chicken and dairy cattle, respectively. Alternating periods of N immobilisation and N mineralisation in fresh manures of goat, pig and chicken was attributed to the 2-phase nature of the manure where the low-N grass bedding induced immobilisation while manure induced mineralisation. It was concluded that composting manure was a good practice as it allowed for the decomposition of bedding material thereby homogenising the manure. However, more studies are required to determine gaseous N losses during aerobic composting especially in chicken and pig manure where a large proportion of the N occurs as urea and uric acid.

Plant nutrient uptake by the maize crop under different erosion levels and granitic sandy soils of Zimbabwe

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Abstract

Sheet erosion selectively removes fine soil particles like organic matter and clay, which are critical in soil productivity as they determine the nutrient-supplying capacity as well as the water-holding capacity of the soils. The process is often insidious and may go unnoticed until yields decline drastically. The use of hybrid seed and fertilizers often masks the seriousness of the problem, but it is not known to what extent. This study, therefore sought to assess the uptake of plant nutrients (N, P, K) under five different erosion levels and two fertilizer levels (normal and double). Different erosion levels were achieved by removing different depths of topsoil (scalping). The results showed that nutrient uptake decreased significantly with increase in erosion (N and P at $P < 0.001$; K at $P < 0.002$). The fertilizer use efficiency decreased drastically from uneroded to severely eroded plots. Doubling the fertilizer amount only increased uptake slightly but fertilizer use efficiency remained overall lower than under normal fertilized plots. Soil conservation is the key to sustained soil productivity through maintenance of soil structure and optimal uptake of water and plant nutrients.

Performance of F₃ Common Bean Populations Under Rain Fed Conditions in Zimbabwe

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Abstract

Common bean (*Phaseolus vulgaris* L.) is an important source of protein for cereal-based diets of Sub-Saharan Africa. Genetic diversity of common bean is organised into Andean and Mesoamerican. In Zimbabwe the most cultivated are the large seeded of Andean origin. Drought stress has been found to be a major constraint to production of Andean cultivars, causing a yield loss of up to 60%. Mesoamerican cultivars exhibit a wide genetic base and are tolerant to drought. Introgression of alleles from across gene pools would broaden the genetic base of cultivars, maximising gains from selection. A field experiment was carried out at Harare Research Station to evaluate performance and combining abilities of 25 F₃ Andean X Mesoamerican populations bred for drought tolerance. The experimental design was a 5 x 5 triple lattice and each plot consisted of four rows, 3 m long and 0.5 m apart. Combining ability estimates were calculated based on Beil and Atkins (1967). There were no significant differences ($p > 0.05$) in agronomic performance of the 25 F₃ Andean X Mesoamerican populations under rain fed conditions. Average 100 seed weight for the populations was 30g with most combinations ranging between 25-33g, which falls within the medium seeded range. Parents PAN 127, PAN 148, SUG 131, SER 8, SER 22 and SEQ 11 were found to have good combining ability. Parents SEQ 11, SER 22 and PAN 127 can be used in breeding for drought tolerance in areas of intermittent and terminal drought because their progeny were early maturing. Hybrids SER22 X CAL143 and SER8 X SUG131 were the best combiners for pod and seed yield. There is also high potential to obtain superior genotypes in crosses SEQ11 X PAN 148, SER16 X SUG131, SEC16 X SUG131, SEC16 X PAN148, SER22 X PAN127, SEQ11 X CAL143 and SER16 X SUG131.

Methods and applications of weed seed bank studies in weed management: A review

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Abstract

Two methods, namely the germination method and the physical separation method are used in weed seed bank studies and are usually correlated to one another. The composition and pattern of weed flora in arable fields are determined by their seed bank structure. Knowledge of the weed seed bank is used for weed emergence timing, measurement of weed shifts or prediction of weed seed dormancy in cropping systems.

Epidemiology of Gastrointestinal Nematodes in Dairy Cattle in farms around Gweru, Zimbabwe

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Abstract

*An epidemiological study of gastrointestinal nematode infections of dairy cows and calves was conducted in two farms in Gweru district from July 2004 to July 2005. Cows had low faecal egg counts during the dry and wet seasons. Calves had significantly higher faecal egg counts during the rainy season than the dry season in both farms ($P < 0.05$). Faecal larval cultures indicated that *Haemonchus*, *Cooperia* and *Trichostrongylus* were the most important nematodes. Pasture larval counts were low during the dry season but increased and peaked in March coinciding with the faecal egg counts peak. Results of the study indicate that next to calves, cows are important contributors to pasture contamination. These categories of cattle would benefit from anthelmintic treatment administered at the end of the dry season and middle of the rainy season.*

Behavioural characteristics of the Scale insect *Aspidoproctus* sp. near *glaber* (Homoptera: Margarodidae) in different instar stages in Miombo woodlands in Hurungwe, Zimbabwe

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Abstract

*The behavioural characteristics of the different instar stages of *Aspidoproctus* sp. near *glaber* (Lindiger) were studied over a period of 10 months from December 1994 to October 1995 on *Brachystegia boehimii* and *Julbernardia globiflora* in the field in Hurungwe, Zimbabwe and on potted *Azelia quanzensis* seedlings in the laboratory at the University of Zimbabwe. The behavioural aspects studied were egg-laying and hatching behaviour, crawler behaviour, settling behaviour, moulting behaviour, honey dew secretion, and over-wintering behaviour. Dissection of 20 randomly selected adult females daily for a period of 10 days during the oviposition period revealed that the scale insect produced eggs in batches and retained them inside the female body where incubation and eclosion took place. Dissection of 20 adult females when the insects were fully distended showed that the number of eggs produced per female ranged from 934 to 5673 (with a mean of 2403 ± 1281 eggs). The newly emerged crawlers congregated around the fringes of the maternal scale before they started dispersing. Crawler emergence and congregation period were strongly affected by ambient temperature. The crawlers moved upwards until they reached the thinner twigs, petioles and leaves in the crown of the host plant where they wandered up and down before settling down to feed. The insect moulted three times and on each moult the insect actually escaped from the old exuvium leaving the latter attached to the host plant. After each moult the insect moved down to a thicker portion of the host plant. Throughout its development, the insect produced copious amounts of honeydew.*

General Guidelines to Authors

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Abstract (Papers must contain an abstract briefly summarising the essential contents: the abstract should not normally exceed 300 words)

Introduction

Materials studied, area description, methods and techniques

Results

Discussion

Conclusion

Acknowledgements

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Figures

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Measurements

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