Systems modeling and farmers' participatory evaluation of cropping options to diversify peanut systems in Anantapur region, India II. Farmers' participatory field assessment of simulated peanut systems

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Abstracts

Through systems simulation we identified peanut/short duration (SD) pigeonpea intercrop systems as the most suitable system for rainfed Anantapur region. Farmers' participated field trials were conducted during 2000-2002 seasons to determine the adoptability of this system for this region. During these seasons, peanut yields were higher with sole peanut although system productivity was consistently higher with peanut/SD pigeonpea systems based on total grain productivity and LER. SD pigeonpea yields were higher compared to medium duration (MD) pigeonpea in the intercrop systems. Adoption of peanut/short duration pigeonpea system by farmers in the neighboring villages during the third cropping season (2002), and better productivity in a severe drought year (2003) benefited farmers. Tools and methodologies employed in this study may well be utilized for similar situations in the SAT.

Media summary

Farmers participated to assess modeled peanut/SD pigeonpea intercrop system in their fields, and demonstrated its adoptability in Anantapur region, as a system to minimize crop failure risks and improved productivity during 2000-02.

Keywords

Short duration pigeonpea, farmers' participatory research, evaluation of peanut systems.

Introduction

We analyzed constraints and opportunities existed in Anantapur region for improving peanut systems productivity and minimizing risk of crop failure through simulation studies. Through these studies, we identified that peanut/SD pigeonpea intercrop system at row ratio of 3:1 would improve the system productivity and minimize the risk of crop failures in low resources environment of Anantapur. We planned to evaluate this system in farmers' fields within Anantapur region to determine its adoptability. Our objective was to evaluate simulated cropping options through farmers' participatory field demonstrations, to determine adoptability of options for improved productivity.

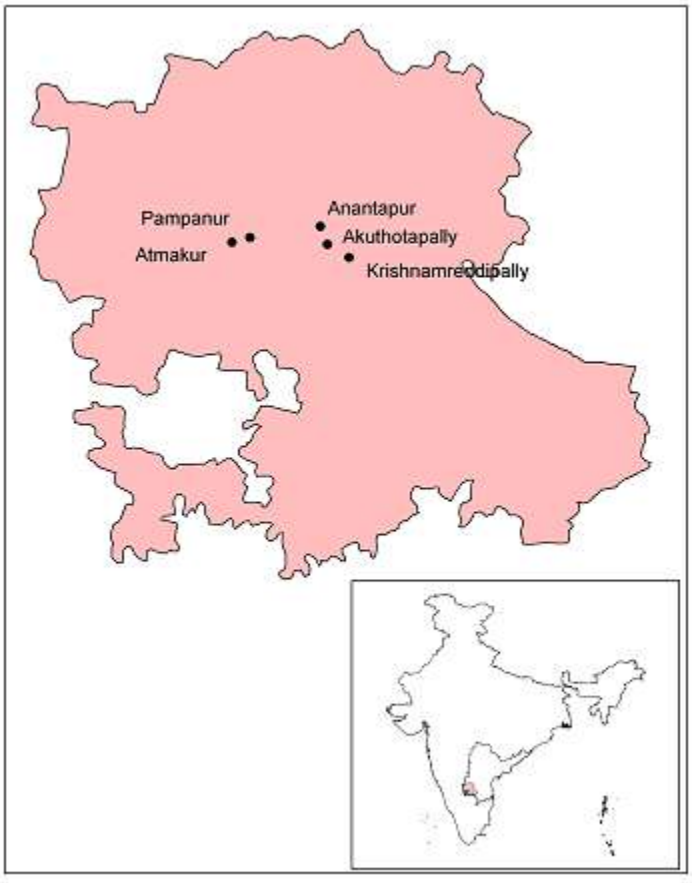
Methods

Survey of farmers

We conducted a rapid appraisal and acquaintance survey of 72 farmers during May 2000 to understand reasons for monocropping of peanut, problems to adopt peanut/MD pigeonpea intercrop system at 7:1 ratio, and enlist years of good harvest of MD pigeonpea as an intercrop within peanut.

Farmers' participatory planning workshop

Farmers and researchers participated in the planning workshop organized on 22nd June 2000 at Agricultural Research Station (ARS), Anantapur before the beginning of the crop season. More than fifty farmers from three villages participated, along with scientists from ICRISAT and ARS, Anantapur. Discussions took place on the issue of climate variability, crop failures and declining peanut productivity. Scientists explained the availability of systems analysis tools to analyze constraints and opportunities with different cropping systems, and also strategies to be adopted for different climatic scenarios. Farmers were informed of APSIM simulated scenarios on different peanut systems, and the suitability of new cropping system (peanut/SD pigeonpea intercrop) for Anantapur climatic conditions to minimize crop failures and to improve peanut productivity. We explained the importance of maintaining required plant populations at 3:1 row ratio for new system of peanut/ short duration pigeonpea. Farmers had several questions to the scientists on SD pigeonpea and its seed availability. Farmers sought clarifications on problems associated with peanut/SD pigeonpea intercropping and row ratios to be adopted. After the useful discussions, many farmers volunteered to participate in the evaluation of the new intercrop system.



District Map. Study villages in Anantapur district within the southern state of Andhra Pradesh, India

Selection of villages and participating farmers

We planned to have two geographically distant locations that are 40km apart, to encompass varying soil profiles of 30, 60, and 90 cm depth to typically represent Anantapur region (District map). Three soil depths (30, 60, 90 cm) were available in Krishnamreddipally, but in another village, Pampanur, only 30 and 60 cm profiles were available. Soil profiles of 90 cm were selected from Akuthotapally village to have

same number of replication of soil types. Twenty four farmers volunteered to conduct field demonstrations from these three villages.

Details of farmers' field evaluations

Field demonstrations of each farmer consisted of 0.2 ha of sole peanut, and 0.2 ha peanut/SD pigeonpea intercrop. Peanut/medium duration pigeonpea was not considered for demonstration, as we wanted to observe each farmer to adopt his choice of row ratio and spacing for this system so as to estimate system yields from same farmer's field. Most farmers sowed at appropriate seed rate and row spacing, to achieve required plant population in the peanut/SD pigeonpea intercrop (TMV-2/UPAS, Manak, Durga, ICP-88034), peanut/MD pigeonpea (TMV-2/LRG-30) and sole peanut (TMV-2) systems during 2000. Two farmers could not participate in conducting field demonstrations for personal reasons. Crop growth samples were collected 4-5 times (three samples of 1.2 m2 crop area per sampling), at different stages of crops (Picture 1 a, b, c) and corresponding soil moisture samples were collected and processed. Final harvest samples were collected (three samples of 3.6 m2 crop area per sampling) and yield estimates were made in all systems for each farmer's field. While all other management options and sampling procedures continued similarly during 2001 and 2002 crop season, farmers preferred ICP-88034 cultivar in place of other SD pigeonpea cultivars after first crop season assessment in the peanut/SD pigeonpea demonstrations.

a. Peanut flowering stage

b. SD pigeonpea flowering stage

c. SD pigeonpea maturity

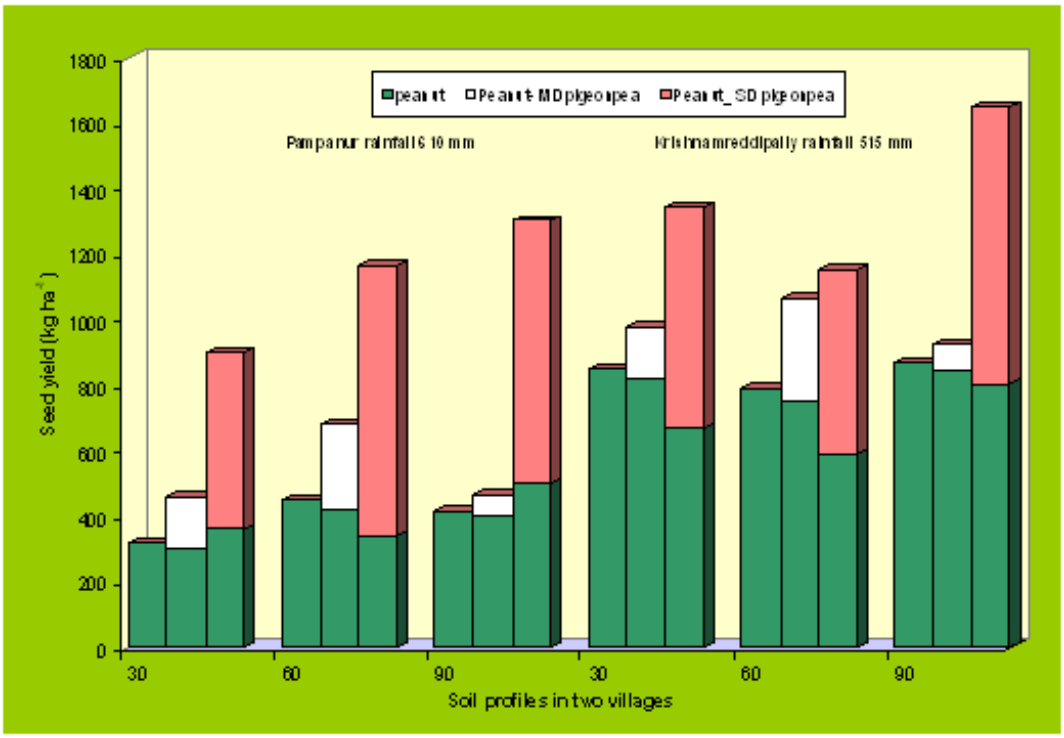
Picture 1. Peanut/SD pigeonpea intercrop at 3:1 row ratio in farmer's field demonstrations in Anantapur

Results from farmers' field demonstrations

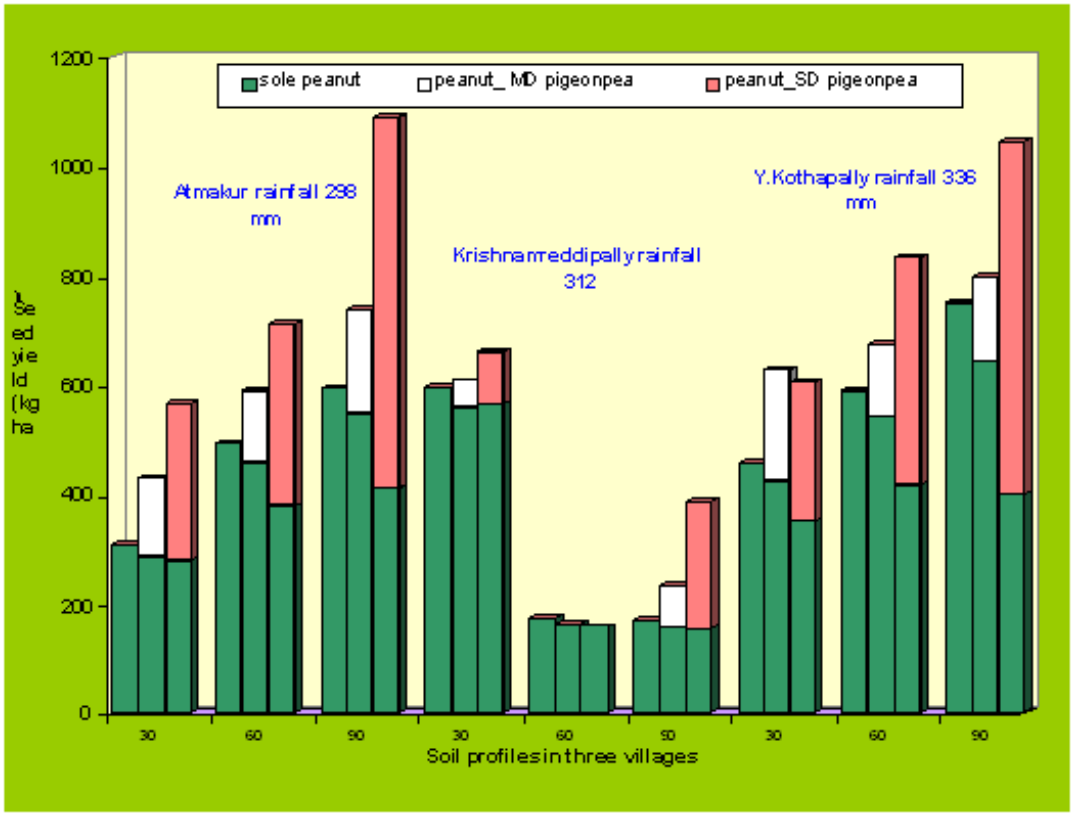
Higher yields of sole peanut were observed through field demonstrations compared to 3:1 peanut/SD pigeonpea intercrop, but the total productivity was significantly higher with peanut/SD pigeonpea as reported by Shindae et al. (1990), Reddy et al. (1990), and Willey (1990). The main reason could be lower population of peanut in the intercrop compared to sole peanut. During the crop season 2000, 15 out of 22 farmers observed yield advantages with peanut / SD pigeonpea intercrop (3:1) as against sole peanut crop. Yield advantages ranged between 217-648 kg ha^{-1} of peanut yield equivalent (1.35 time of pigeonpea seed, based on previous five year average market price of peanut and pigeonpea) with the four SD pigeonpea cultivars as intercrops. These yield advantages were recorded with farmers' fields which had maintained suggested partially additive populations of peanut (75% of sole) and SD pigeonpea (75% of sole) in intercrop, were almost similar to 73% of peanut and 76% of pigeonpea reported from field experiments by Shindae et al. (1990), for higher productivity as well as seed quality of both the component crops. Shindae et al. (1990) observations indicate an LER of 1.28 compared to our observation of (mean) LER 1.57 with peanut/short duration pigeonpea due to higher pigeonpea yield.

During the second crop season (2001), all twenty-two farmers recorded higher productivity with peanut/SD pigeonpea intercrop. For 16 farmers, SD pigeonpea yields exceeded 500 kg ha-1, and 19 out of 22 farmers observed increase in total productivity with peanut/SD pigeonpea intercrop system

compared to peanut/MD pigeonpea, mainly due to SD pigeonpea yield contribution on escape from terminal stress. For simulated yield estimates, soil depth and moisture retention showed a marked variation in crop yields of the 3:1 peanut/SD pigeonpea intercrop. This was evident in field observations when each peanut system yield was averaged for a location (due variation in rainfall) to compare based on soil profile (Fig 1). Even though crop season 2002 was very dry**,** SD pigeonpea yields were more than 250 kg ha-1 with 14 farmers, and 17 of the 22 farmers recorded higher productivity with the peanut/SD pigeonpea intercrop system. Elsewhere, MD pigonpea completely failed because of short crop season and terminal stress.



Crop season 2001



Crop season 2002

Figure 1. Peanut and pigeonpea mean seed yield with peanut systems as observed on farmers' fields of 30,60, 90 cm soil depths during 2001 and 2002 that were erratic rainfall seasons.

Farmers Assessment of the system

Farmers expressed that ICP-88034 exhibited more branching, extendable vegetative phase, bigger seed size and higher yields; hence they chose this variety for further evaluation during 2001 and 2002. Farmers indicated peanut yield reduction is not desirable although there are considerable yield gains due to pigeonpea and overall system productivity during 2001 and 2002; those were very risky crop seasons with low and erratic rainfall. In their observation, SD pigeonpea is escaping terminal stress as well as severe load of pod borer during November-December.

Conclusions

Farmers' field evaluation of peanut/SD pigeonpea systems in two erratic and low rainfall seasons out of three, reveals that observed average productivity of these systems on different soil profiles and locations was inline with simulated estimates, indicating dependability of a simulation approach to analyze climatic and other production constraints to identify appropriate cropping systems for a region. Adoption of peanut/SD pigeonpea system by farmers in the neighbouring villages during third cropping season (2002), and better productivity in a severe drought year (2003) is an evaluated benefit to farmers. Tools and methodologies employed in this study may well be utilized for similar situations in the SAT.

Acknowledgements

We acknowledge APSRU/ACIAR for providing APSIM software for research purpose and providing updates of the software regularly. Our sincere thanks are due to Theme leaders of GT-Agroecosystems

for funding the project. We thank all the farmers for their contribution by participatory evaluation of this system in their fields.

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