# EFFECTS OF LAND TENURE SYSTEM ON INPUT UTILIZATION AND FARM-LEVEL PRODUCTIVITY IN PLATEAU STATE

**D. F. Fulus;** M. A. Ojo; L. Tanko; M. A. Ndanitsa
[1]Department of agricultural economics and Farm Management
Federal University of Technology Minna, Niger State, Nigeria
[*]Corresponding author e-mail and Phone number: fulusdung11@gmail.com 08062594745

**ABSTRACT**
This study examined the effects of land tenure systems on input utilization and farm level productivity among smallholder food crop farmers in Plateau State. Primary data were collected in the 2022 production season from 124 farmers selected through a multistage sampling technique. Descriptive statistics were used to identify prevailing tenure arrangements, while Total Factor Productivity and the Household Commercialization Index measured farm performance and market orientation respectively. The Three Stage Least Squares model was employed to account for the simultaneous relationships among productivity, input utilization and commercialization behaviour. Results revealed the dominance of inherited land among farmers, indicating the continued importance of customary tenure systems in the state. Crop productivity varied across enterprises, with yam recording the highest yield and cowpea the lowest, suggesting persistent cereal yield gaps. Commercialization levels were moderate to high for maize, rice and yam, reflecting partial market integration of smallholders. Econometric estimates showed that extension visits, labour use and rental tenure significantly enhanced farm productivity. However, rental arrangements negatively affected fertilizer utilization, indicating that short term tenure may discourage soil investment despite productivity gains. More secure tenure forms, particularly inherited and purchased land, positively influenced the use of agrochemicals, improved seeds and labour. The findings highlight the complex and heterogeneous effects of tenure categories on farmers' production decisions. The study concludes that land tenure arrangements shape agricultural intensification pathways through multiple behavioural channels. Policy efforts in Plateau State should therefore move beyond binary ownership reforms and instead strengthen tenure security across diverse land access modes while expanding access to credit, extension and output markets. Such integrated interventions are essential for stimulating input use and improving smallholder productivity in the state.
**Keywords: Land tenure; Input; Productivity; Effects and Smallholder**

## INTRODUCTION

Secure and equitable land tenure remains a central pillar for enhancing agricultural input utilization and improving farm level productivity across developing economies. Globally, agriculture employs about 26% of the labour force and contributes significantly to food security and rural livelihoods, yet productivity growth remains uneven, particularly in regions where land rights are weak or uncertain (Food and Agriculture Organization, 2023; World Bank, 2022). Empirical evidence consistently shows that farmers who enjoy secure land tenure are more likely to invest in productivity enhancing inputs such as fertilizer, improved seeds, agrochemicals and mechanisation. Howver, tenure insecurity discourages long term investments and limits access to credit, thereby constraining agricultural transformation. Despite global progress in land governance reforms, an estimated 70% of the world's rural population still lacks formally documented land rights, a situation that continues to undermine sustainable agricultural intensification (FAO, 2023). These global realities underscore the need for context specific investigations that clarify how tenure arrangements translate into farm level behaviour. Within the African context, the interaction between land tenure systems and farm performance is particularly pronounced due to the dominance of customary landholding arrangements. Agriculture accounts for about 60% of employment in sub–Saharan Africa, yet the region records some of the lowest crop yields globally (World Bank, 2023). Studies indicate that tenure insecurity reduces farmers' willingness to adopt improved technologies and modern inputs, thereby perpetuating low productivity traps. For instance, average cereal yields in sub–Saharan Africa remain below 2 tons per hectare compared with over 4 tons per hectare in many parts of Asia (FAO, 2022). Although several African countries have initiated land reforms, implementation gaps, weak land administration systems and overlapping customary and statutory frameworks continue to limit the productivity gains expected from secure land rights. Consequently, understanding how different tenure arrangements influence farmers' input decisions has become a major research and policy priority across the continent, particularly in countries where smallholder agriculture dominates.

Nigeria mirrors many of these continental challenges despite its vast agricultural potential. The sector contributes about 22% to national GDP and employs more than one third of the labour force (National Bureau of Statistics, 2024; World Bank, 2023). However, farm level productivity remains relatively low, partly due to limited adoption of modern inputs and persistent land tenure constraints. The Land Use Act of 1978 sought to harmonise land administration, yet in practice, smallholder farmers continue to operate under a mix of inherited, rented, purchased and communal tenure systems, many of which provide weak security. National statistics indicate that fertilizer consumption in Nigeria averages about 20 kg per hectare, far below the Average target of 50 kg per hectare (Federal Ministry of Agriculture and Food Security, 2023). This persistent input gap reflects deeper structural barriers, including insecure land rights, high input costs and limited access to agricultural credit. Taken together, these conditions suggest that tenure related constraints may be an important but insufficiently unpacked driver of Nigeria's modest farm productivity performance.

Despite the recognised importance of land tenure in agricultural development, notable knowledge gaps persist in the Nigerian literature. A considerable number of earlier empirical studies have tended to treat land tenure as a simple ownership versus non ownership dichotomy, thereby masking the heterogeneous behavioural effects associated with specific tenure arrangements such as inheritance, rental, purchase and gifting. For example, studies by Adeniyi (2018) and Odoemenem and Obinne (2010) examined tenure security primarily through ownership status without sufficiently differentiating how alternative tenure pathways shape farmers' investment incentives. Similarly, research by Lawal et al. (2019) focused largely on access to land rather than the nuanced tenure rights that condition input use decisions. While these contributions advanced understanding of tenure security broadly, their binary treatment limits policy precision in contexts where multiple tenure forms coexist.

More recent Nigerian studies have begun to recognise the complexity of tenure systems, yet important analytical gaps remain. For instance, Aliyu *et al.* (2021) investigated land tenure and agricultural productivity in northern Nigeria but concentrated mainly on yield outcomes without simultaneously modelling input utilization behaviour. Likewise, studies such as Yusuf *et al.* (2020) and Eze *et al.* (2022) explored determinants of input adoption among smallholders but paid limited attention to how distinct tenure categories condition those adoption decisions. As a result, the transmission mechanism linking tenure arrangements to productivity through input use remains insufficiently unpacked in the Nigerian context. Against this background, the broad objective of this study is to examine the effects of land tenure systems on input utilization and farm level productivity in Plateau State, Nigeria. Specifically, the study seeks to:

(i) identify the prevailing land tenure arrangements among food crop farmers in the study area;
(ii) determine the level of farm level productivity of selected food crops in the study area;
(iii) Identify the level of Food Crop Commercialization in the study area; and
(iv) evaluate the influence of land tenure arrangements on input utilizations.

## METHODOLOGY

### Study Area

The study was conducted in Plateau State, Nigeria. The state lies between longitudes 8°32′E and 10°38′E and latitudes 8°24′N and 11°15′N, covering an estimated land area of about 26,899 square kilometres. Plateau State is located within the Northern Guinea Savanna agro ecological zone and is characterised by moderate climatic conditions with mean annual temperatures ranging from 18 to 22°C and altitude of approximately 1,317 to 1,460 metres above sea level. The state has an estimated population of about 4,727,634 persons. Agriculture constitutes the dominant livelihood activity in the area, with major food crops including potatoes, rice, maize, cassava, cowpea, yam, soybean, groundnut and sorghum. The ecological suitability of the state for diverse crop production makes it appropriate for analysing how land tenure arrangements influence input utilization and farm level productivity among smallholder farmers.

### Sampling Procedure and Sample Size

A multi stage sampling technique was employed to select respondents for the study in line with standard procedures for agricultural household surveys. In the first stage, 20 percent of the Local Government Areas (LGAs) in Plateau State were selected using simple random sampling to ensure adequate spatial representation. In the second stage, 10 percent of the farming communities were randomly selected from each of the chosen LGAs. The third stage involved determination of the sample size using Cochran's formula for population proportions as recommended by Israel (1992). This approach ensures statistical representativeness where the sampling frame is large.

Following sample size determination, smallholder farmers engaged in the production of maize, rice, cowpea and yam were identified with the assistance of village heads and resident agricultural extension agents. From this sampling frame, respondents were selected using simple random sampling. A total of 124 food crop farmers constituted the final sample size for the study. The focus on these crops was informed by their economic importance and prevalence within the study area.

**Data Collection**

Primary data were collected through the use of a structured questionnaire administered during the 2022 production season. Information obtained covered household socio economic characteristics such as age, sex, marital status, household size, educational level, years of farming experience, membership of farmers' associations, and access to credit and extension services. In addition, detailed farm level data were collected on input use, output levels, prevailing market prices, land tenure arrangements and production constraints. Farm size measurements were obtained through physical field measurements where necessary using measuring tape and Global Positioning System (GPS) devices to enhance accuracy. Data on input costs including fertilizer, agrochemicals, labour and improved seed, as well as output quantities and prices, were used to compute key analytical indicators such as household commercialization index, input utilization intensity and farm level productivity.

**Analytical Techniques**

**Descriptive Statistics**

Descriptive statistics including frequencies, percentages, means and standard deviations were employed to describe the socio-economic characteristics of farmers and to identify the prevailing land tenure arrangements in the study area.

**Total Factor Productivity**

Farm level productivity was measured using Total Factor Productivity (TFP). The TFP index captures the ratio of aggregate output to aggregate input use and provides a comprehensive measure of production efficiency beyond partial productivity indicators. It is specified as:

$$TFP = \frac{\text{Total Value of Output}}{\text{Total Value of Variable Inputs}}$$

**Household Commercialization Index**

The level of food crop commercialization was analysed using the Household Commercialization Index (HCI), which measures the proportion of total crop output that is marketed. It is expressed as:

$$HCI = \left(\frac{\text{Gross Value of Crop Sales}}{\text{Gross Value of Crop Production}}\right) \times 100$$

The index ranges from 0 to 100, where higher values indicate greater market orientation of the farm household.

**Three Stage Least Squares Model**

To evaluate the effects of land tenure systems on input utilization and farm level productivity while accounting for potential simultaneity among key variables, the Three Stage Least Squares (3SLS) econometric technique was employed. The choice of 3SLS is justified by the likelihood that input use decisions, commercialization behaviour and productivity outcomes are jointly determined within the farm household.

The structural model consists of a system of simultaneous equations in which farm productivity and input utilization functions are estimated jointly. The general form is specified as:

$$Y_1 = f(X_1, T, \varepsilon_1)$$
$$Y_2 = f(X_2, T, \varepsilon_2)$$
$$Y_3 = f(X_3, T, \varepsilon_3)$$

where $Y_1$represents farm level productivity, $Y_2$denotes input utilization intensity, $Y_3$captures commercialization behaviour, $T$represents land tenure categories, $X_i$are vectors of household and farm characteristics, and $\varepsilon_i$are stochastic error terms.

**RESULTS AND DISCUSSION**

**Land ownership pattern among farmers**

The distribution of land tenure arrangements in Table 1 reveals the continued dominance of customary based access to farmland in Plateau State. A substantial majority of farmers operated on inherited land, accounting for 111 farmers cultivating 182.4 hectares, with an average holding of 1.64 hectares per farmer. This pattern confirms the centrality of intergenerational land transfer in the smallholder production system. Although inherited land offers relative tenure stability, the relatively small average holding suggests potential land fragmentation, which may constrain economies of scale and mechanisation.

Rented land recorded the highest average farm size of 2.03 hectares per farmer, followed by purchased land at 1.92 hectares. This finding indicates that farmers who access land through market mediated mechanisms tend to operate slightly larger plots. However, the relatively low number of farmers in the purchased and gifted categories suggests that land markets remain thin and imperfect. From a food policy perspective, the predominance of inheritance-based tenure implies that productivity enhancing investments may depend heavily on the perceived security of customary rights rather than formal title. Similar patterns have been documented in Nigerian smallholder systems where customary tenure continues to shape production incentives.

**Table 1: Land Ownership Pattern in Plateau State**

| Land Type | No. of Farmers | No. of Ha | Ha/Farmer |
|---|---|---|---|
| **Inherited** | 111 | 182.4 | 1.64 |
| **Purchased** | 12 | 23.2 | 1.92 |
| **Gifted** | 10 | 15.8 | 1.58 |
| **Rented** | 18 | 36.5 | 2.03 |

**Crop productivity performance**

Table 2 presents the productivity levels of selected food crops. Yam recorded the highest yield at 10.004 tons per hectare, reflecting the crop's biological potential and the relatively intensive management typically associated with yam cultivation. Rice and maize exhibited moderate productivity levels of 1.756 and 1.741 tons per hectare respectively, while cowpea recorded the lowest yield at 0.394 tons per hectare.

When situated within the broader African productivity context, maize and rice yields remain below attainable global averages, suggesting persistent yield gaps in the study area. The relatively low cereal productivity aligns with earlier evidence that smallholder systems characterised by limited input intensity and tenure uncertainty often experience sub optimal output levels. The findings therefore reinforce the argument that improving input utilization, particularly fertilizer and improved seed adoption, remains critical for closing yield gaps in Plateau State.

**Table 2: Levels of Productivity of Selected Crops in Plateau State**

| Crop | Output (Tons) | Area (Ha) | Output/Ha (Tons) |
|---|---|---|---|
| Maize | 512.9 | 294.6 | 1.741 |
| Rice | 115.05 | 65.5 | 1.756 |
| Cowpea | 32.71 | 83 | 0.394 |
| Yam | 305.125 | 30.5 | 10.004 |

Field Survey, 2022.

**Level of food crop commercialization**

The commercialization pattern in Table 3 indicates varying degrees of market participation across crops. Maize exhibited the highest commercialization level, with 83.2 percent of output sold, followed by rice at 63.1 percent and yam at 60.3 percent. Cowpea showed the lowest commercialization ratio at 41.2 percent. The relatively high commercialization of maize suggests its dual role as both a staple and a market-oriented crop in the state. The substantial output differences between production and sales, particularly for yam and maize, imply that a portion of output is retained for household consumption, seed reservation or post-harvest losses. From a food policy standpoint, the moderate to high commercialization levels indicate that smallholders in Plateau State are partially integrated into output markets. However, the lower commercialization of cowpea suggests crop specific market constraints that may require targeted value chain interventions. Importantly, commercialization behaviour may also interact with tenure security by influencing farmers' incentives to intensify production.

**Table 3: Level of Food Crop Commercialization in Plateau State**

| Crop | Output Harvested (Tons) | Output Sold (Tons) | Percentage Sold (%) | Output Difference (Tons) |
|---|---|---|---|---|
| Maize | 512.9 | 426.54 | 83.2 | 86.36 |
| Rice | 115.05 | 72.6 | 63.1 | 42.45 |
| Cowpea | 32.71 | 13.48 | 41.2 | 24.48 |
| Yam | 305.125 | 184.03 | 60.3 | 121.1 |

Field Survey, 2022.

**Effects of land tenure on input utilization and productivity**

The results from the Three Stage Least Squares (3SLS) estimation provide robust insights into the multifaceted effects of land tenure arrangements on input utilization and farm-level productivity among smallholder farmers in Plateau State. The model demonstrates strong explanatory power across key input and productivity equations, with $R^2$ values ranging from 0.5065 to 0.982, reflecting a high degree of fit, particularly for improved seed adoption. These findings offer nuanced evidence on the mechanisms through which tenure arrangements

shape agricultural outcomes, in line with empirical discussions in leading food policy literature.

**Land Tenure and Farm-Level Productivity**

The analysis indicates that tenure types exhibit heterogeneous effects on productivity. Rented land shows the largest positive coefficient on productivity ($\beta = 3.1805$, $p < 0.01$), followed by inherited land ($\beta = 1.351$, $p < 0.10$) and gifted land ($\beta = 0.8688$, $p < 0.10$). This result is consistent with the land rental market efficiency hypothesis, suggesting that rental arrangements enable commercially oriented or resource-efficient farmers to access land, thereby achieving higher output per hectare. While rental tenure is typically associated with short-term access and potential insecurity, its strong association with productivity implies that farmers who engage in rental markets may possess greater managerial skills, capital endowments, or market orientation, enabling them to optimize returns over limited periods. This finding aligns with observations in sub-Saharan African contexts, where functional rental markets facilitate the reallocation of land to more productive operators (Deininger & Jin, 2006; Lawal et al., 2019).

Inherited land also positively influences productivity, reflecting the relative stability and security afforded by intergenerational transfers. Secure tenure allows farmers to invest in labour-intensive practices, crop management, and improved seeds, consistent with investment theory in agricultural economics. Gifted land exerts a smaller but positive influence, suggesting that even informal transfers may encourage productivity when tenure perceptions are sufficiently secure.

Age has a significant negative effect on productivity ($\beta = -0.0125$, $p < 0.05$), indicating that younger farmers are more likely to achieve higher output, possibly due to greater physical capacity, willingness to adopt innovations, or responsiveness to extension services. Conversely, labour availability positively affects productivity ($\beta = 0.0981$, $p < 0.10$), highlighting the labour-intensive nature of smallholder agriculture in the state. Extension visits also demonstrate a highly significant positive effect ($\beta = 1.3641$, $p < 0.01$), reinforcing the critical role of advisory services in translating input use into measurable productivity gains.

**Fertilizer Utilization**

Fertilizer use is positively influenced by market access, credit availability, cooperative membership, extension contact, and total factor productivity. These findings underscore the importance of institutional and market mechanisms in facilitating input intensification. Notably, rented land exhibits a negative coefficient for fertilizer use ($\beta = -7.7448$, $p < 0.05$), suggesting that the short-term nature of rental agreements discourages investments in soil fertility-enhancing inputs despite positive productivity outcomes. This apparent paradox reflects a behavioural trade-off: while rented plots may be managed efficiently, tenure insecurity limits long-term capital investments. Such findings are consistent with evidence from African contexts showing that tenure insecurity can constrain adoption of costly and long-term inputs even when short-term gains are achievable (Aliyu et al., 2021; FAO, 2023).

**Agrochemical Use**

Household commercialization, income, credit availability, and tenure types, particularly inherited and purchased land, positively drive agrochemical adoption. The positive effect of inherited and purchased land ($\beta = 5.5343$ and $\beta = 6.529$, respectively) highlights the role of secure tenure in fostering investment in chemical inputs, consistent with the theory that tenure security incentivizes resource commitment for productivity enhancement. Fear of low yields also significantly increases agrochemical use, indicating that risk perceptions influence input intensification decisions.

**Improved Seed Adoption**

Farm size exerts a strong positive influence on high-yielding seed adoption ($\beta = 16.9744$, $p < 0.01$), illustrating that scale advantages facilitate technology uptake. In addition, inherited and purchased lands significantly promote improved seed use, highlighting the synergy between tenure security and the adoption of modern technologies. Extension visits and credit availability further reinforce seed adoption, reflecting the importance of knowledge transfer and access to financing in enhancing technological engagement among smallholders.

**Labour Utilization**

Labour use is positively associated with inherited land, market access, fear of low yield, and extension contact, indicating that secure tenure and institutional support encourage greater deployment of both family and hired labour. Total factor productivity also positively influences labour allocation, suggesting that more productive plots attract higher labour investment. The absence of a significant effect of rented land on labour use may indicate that tenants strategically limit labour-intensive investments in short-term plots, further supporting the notion that tenure security conditions input deployment decisions.

**Table 4: Regression estimates of effects of land tenure system on input utilization and farm-level productivity** in **Plateau State**

| | Productivity | Fertilizer used | Agrochemical used | High yielding seed | Labour used |
|---|---|---|---|---|---|
| Explanatory Variables | Coefficient (Z-value) | Coefficient (Z-value) | Coefficient (Z-value) | Coefficient (Z-value) | Coefficient (Z-value) |
| High Yielding variety | - | -0.8944 (-0.94) | - | - | 1.0481** (2.26) |
| Market access | 0.1065 (1.00) | 2.8569** (2.39) | 0.1237 (1.43) | 0.2074 (0.63) | 0.9071* (1.72) |
| Household commercialization | 0.7486 (0.47) | -0.1591 (-0.28) | 1.6926* (1.86) | 0.2646*** (3.90) | 1.1583 (0.12) |
| Labour | 0.0981* (1.77) | 0.0001** (2.00) | 0.0362 (0.87) | -0.2087 (-0.74) | - |
| Credit availability | 0.0000 (0.40) | 2.8569** (2.39) | 0.8250** (2.21) | 0.4535** (2.18) | 1.3425 (1.61) |
| Membership of cooperative | - | 7.046** (2.03) | - | 0.4879 (0.22) | - |
| Cost of tractor service | -0.2345*** (2.76) | - | -0.0125*** (-2.69) | - | - |
| Fear of low yield | - | - | 0.3776*** (15.55) | - | 0.3220** (2.50) |
| Farm size | 0.0349 (0.13) | - | 0.0061 (0.01) | 16.9744*** (34.07) | 18.071** (2.12) |
| Educational level | 0.1084 (1.43) | - | - | - | - |
| Age | -0.0125** (-2.62) | - | - | - | - |
| Income | - | - | 0.6900* (1.84) | - | 0.0000*** (2.89) |
| Access to information | - | - | 0.7753 (0.81) | - | - |
| Extension visit | 1.3641*** (4.27) | 4.952** (2.47) | - | 2.5271** (2.27) | 0.0000 (0.89) |
| Agrochemical | 0.0042 (0.57) | 0.1514*** (2.75) | - | - | 0.848 (0.50) |
| Cost of fertilizer | 0.0473*** (4.28) | -0.0019*** (-5.95) | - | - | - |
| Cost of FYM | - | -0.00001 (-0.39) | - | 0.0010 (0.15) | - |
| Total Factor Productivity | - | 4.0242* (1.88) | - | 1.4408** (2.45) | 3.4535** (2.31) |
| Inherited | 1.351* (1.69) | 1.2381 (0.09) | 5.5343*** (4.32) | 0.6704* (1.87) | 4.2429*** (2.90) |
| Purchased | 1.246 (0.81) | 7.1861 (0.74) | 6.529*** (3.76) | 0.4273 (0.08) | 4.5013 (1.53) |
| Gifted | 0.8688* (1.97) | 12.427* (1.67) | 1.3266 (1.52) | 3.9252* (1.78) | - |
| Rented | 3.1805*** (1.74) | -7.7448** (-2.15) | 1.9500 (1.26) | -4.4468 (-0.85) | 2.9232 (0.33) |
| Constant | 17.829 (1.99) | 73.5865 (1.8) | 9.5373 (1.62) | 37.5531 (0.99) | 163.9221 (11.06) |
| R-squared | 0.6734 | 0.5065 | 0.982 | 0.5065 | 0.5504 |
| Chi2 | 74.55 | 213.74 | 34 | 1406 | 229.19 |
| P- Value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

*, **, ***=significant at 10%, 5% and 1%. Figures in parentheses are t-values Source: Field Survey, 2022.

## CONCLUSION AND RECOMMENDATION

The study demonstrates that land tenure arrangements in Plateau State significantly influence input utilization and farm-level productivity. Inherited land dominates, providing relative security, while rented, purchased, and gifted plots exhibit varied effects on production decisions. Productivity remains modest for cereals but high for yam, reflecting yield gaps linked to limited input use and tenure constraints. Secure tenure, particularly inherited and purchased land, promotes agrochemical, improved seed, and labour investment, whereas rented land boosts productivity but discourages long-term soil inputs. Overall, tenure security, coupled with extension services, credit access, and market integration, is crucial for enhancing smallholder productivity and commercialization.

**RecommendationsRECOMMENDATIONS**

i. Land policy reforms in Plateau State should prioritise strengthening tenure security within customary systems rather than focusing exclusively on formal titling. Community based land documentation, locally recognised certificates of occupancy and improved land record systems would enhance farmers' confidence to invest in productivity enhancing inputs while respecting existing social institutions.

ii. Given the strong productivity effect associated with rental arrangements alongside their negative influence on fertilizer investment, policies should aim to formalise and stabilise rural land rental markets. Developing simple, low-cost rental contracts with minimum duration guidelines would reduce uncertainty for tenants and encourage soil fertility investments. State agricultural agencies and local governments can collaborate with traditional authorities to standardise rental agreements.

iii. Extension services should be scaled up substantially, as they exhibit one of the most consistent positive effects across the productivity and input use equations. Increasing the frequency of extension visits, strengthening farmer field schools and promoting tenure aware advisory messages will accelerate technology adoption. Particular emphasis should be placed on improved seed and integrated soil fertility management for cereal crops where yield gaps remain wide.

iv. Access to agricultural credit must be expanded through cooperative based lending, input credit schemes and value chain financing models. The strong role of credit in driving fertilizer, agrochemical and improved seed use indicates that liquidity constraints remain a major barrier to intensification. Financial products tailored to smallholders operating under customary tenure should be prioritised.

v. Market access improvements, including rural road rehabilitation, aggregation centres and structured output markets, should be pursued to reinforce the positive link between commercialization and input intensification. Since maize shows the highest commercialization potential, value chain development efforts may initially target maize clusters while designing crop specific interventions for cowpea and rice.

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