Profitability of different management options for Sorghum cultivation in Dodoma, Tanzania

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1. Introduction

Globally, about 1.1 billion people continue to live in extreme poverty on less than US$1 a day. Another 1.6 billion live on between US$1–2 per day. Most of them depend on agriculture for their livelihoods, directly or indirectly. In much of sub-Saharan Africa, agriculture offers a promising opportunity for spurring growth, overcoming poverty, and enhancing food security. Of the total population of sub-Saharan Africa in 2009, 63% lived in rural areas. Broad-based agricultural development through improving the productivity, profitability and sustainability of smallholder farming is the main pathway out of poverty for millions of poor farm households. Agricultural productivity growth is also vital for stimulating growth in other sectors of the economy. But accelerated growth requires a sharp productivity increase in smallholder farming.

In Tanzania, 74% of the population lives in rural areas and 77% of all employed people are employed in agriculture. 40 % of the total area of the country is generally considered to be suitable for agriculture and the sector accounts for about 29% of the country's Gross Domestic Product (GDP) (World Bank 2011). The productivity of agriculture is however low due to low level of use of improved technologies, risks associated with weather conditions and certain management practices. The farmers have been growing sorghum in Tanzania with the minimal or no fertiliser without realizing the potential of different sorghum cultivars in that environment. They are also not aware of the benefit they can gain by using specific management practices for particular cultivars. Instead they use a blanket approach for all the cultivars. As a result, they fall short of the achievable profits from the sorghum cultivation.

In Tanzania increasing the productivity of cereals presents an opportunity in reversing the trends in productivity, poverty and food insecurity. Sorghum is well adapted to dryland areas and produces reasonable yields in times of drought. This enables a more productive use of land, particularly in areas where rainfall is scarce and unreliable. Considering the perspectives for climate change, this aspect becomes even more important. Second, it reduces malnutrition and improves human health. Third, the growing demand of sorghum for different end-users e.g., brewery provides a source of cash for smallholder producers.

1.1 Objectives

The objectives of this work are (i) to identify best management practices for different cultivars of sorghum and (ii) to determine the profitability and rate of return of the best management practices.

1.2 Rationale

For a particular sorghum cultivar the best management practices must be evaluated in order to make the sorghum cultivation profitable in an environment. It might be difficult or impractical to assess the effect of different management options on the yield through long-term agronomic field experiments and establish the profitability of these options over a period of time. Hence the use of a crop model, to simulate the grain yield over a long period for different management options, may be necessary to establish the profitability of different management options and help select the best options. The crop model can provide robust and resilient recommendations obtained from a long term simulation, the rate of return and the risk associated with these recommendations.

2. Data and methods

2.1 Location

The chosen location for this work was Dodoma (6° 10'S, 35° 44'E) situated in the dryland areas of Tanzania characterized by low amounts of rainfall with erratic distribution having an altitude of 1109 m above sea level. The temperature ranges from 11 to 34°C. The mean annual rainfall varies between 600 and 900 mm. Over the last 11 year period (1997-2007) the growing season rainfall averaged to 341 mm while the maximum and minimum growing season rainfall was observed to be 531 and 184 mm respectively. The dominant soil type of this area is Ferric Acrisols.

The daily weather data for this work was obtained from NASA Prediction of World Energy Resources (POWER) Agroclimate Database available at the following website. http://power.larc.nasa.gov/cgi-bin/cgiwrap/solar/agro.cgi?email=agroclim@larc.nasa.gov

The POWER database provides satellite remote sensing-estimated daily weather variables (e.g., minimum and maximum temperature, rainfall, and solar radiation) globally at 1-degree grids. The latitude and longitude of the Dodoma location were given as input to obtain the daily weather data.

2.2 Sorghum Varieties

Some of the sorghum varieties have been released over the years for the Tanzanian locations with the help of the research conducted by ICRISAT along with the national research institutes. Three of the popularly grown varieties are Macia, Sima and Pato. Macia takes about 71 days to have 50% flowering and 110 days to physiologically maturity where as Sima and Pato take about 77 and 79 days to flower and 115 and 117 days to mature respectively (based on experiment conducted in year 2000). Their traits are given in Table 1.

Table 1. Properties of different sorghum cultivars

S. N.	Cultivar	Maturity	Height	Grain colour	Grain size	Yield	Consumption	Brewing quality
1	Macia	Early	Semi-dwarf	White	Medium	High	Food grain	Good
2	Sima	Medium-Late	Medium Tall	White	Large	Low	Food/Forage	Good
3	Pato	Late	Tall	Cream/ Yellow	Large	Low	Food grain	Excellent

2.3 Soil conditions

Soil information was available from the Dodoma location. Soil layer depths sampled were: 0-15, 15-60 and 60-80 cm. An additional layer of 80-110 cm was incorporated in the soil data to make soil water available from a depth of 110 cm. Soil properties of this layer were similar to that of layer 60-80 cm. Average bulk density (BD) for the top layer was 1.4 g cm^{-3}, for 15-60 cm layer was 1.32 and for the bottom two layers was 1.33 g cm^{-3}. The clay content was 28.6, 41.8, 38.2 and 37% for these four layers from top to bottom. The sand content for these four soil layers from top to bottom was 66, 50.2, 47.2 and 45%. Soil water parameters for plant lower limit (LL), drained upper limit (DUL) and

saturation (SAT) of soil layers were described to give a plant available water holding capacity (0-110 cm) of 111 mm. These Soil Hydraulic Properties were obtained from the U.S. Texture Triangle available at
http://www.pedosphere.com/resources/texture/worktable_us.cfm.
The soil is low in organic carbon content with 0.49, 0.36, 0.20 and 0.15% for the four layers from top to bottom.

2.4 Calibration of APSIM for different sorghum cultivars

The calibration of the sorghum cultivars was based on matching the APSIM output of days to 50% flowering, days to physiological maturity and grain yield to their corresponding observed values. Crop data was available for only one year for all 3 cultivars. There are several variables to describe a sorghum cultivar's specific characteristics of growth and development in the Sorghum.XML input file. Five of them are the inputs of thermal time (TT, °C-d) to describe different stages of plant development from emergence to maturity; two parameters describe the leaf area following the total plant leaf area (TPLA) approach. The following table lists the major adjustment to sorghum cultivar-specific parameters to suit the 3 selected cultivars.

Table 2. The cultivar-specific parameters adjusted to match the observed days to flowering, days to maturity and grain yield of three sorghum cultivars.

S.N.	Parameter	Unit	Cultivar		
			Macia	Sima	Pato
1	Thermal time from end of juvenile to initiation	°C-d	125	135	145
2	Thermal time from flag to flowering	°C-d	120	170	175
3	Thermal time from flowering to start of grain filling	°C-d	100	100	100
4	Thermal time from flowering to maturity (base temperature =5.7 °C)	°C-d	630	575	575
5	Main stem coefficient (power coefficient for TPLAmax)	1/°C	2.42	2.26	2.25
6	curvature coefficient for leaf area	1/°C	0.018	0.013	0.010

The initial maximum available water to the crop was set at 20% of the total available water, i.e. 22 mm. The initial mineral N of the soil profile was set at 9 kg ha^{-1} NO_3 and 3 kg ha^{-1} NH_4. The sowing rule was set so that sowing took place when there was an accumulation of 35 mm of rainfall within a five consecutive days period. The sowing window was kept between 20 January and 25 February to ensure sowing of the crop near to the onset of the rainy season. The row spacing was kept at 75 cm with the plant to plant distance of 15 cm to give a plant population of 88,888 plants ha^{-1} as used by most of the farmers. Farmers do not apply any fertiliser at sowing or at later stage as topdressing.

The following table shows the observed and simulated values of different parameters during calibration. The observed values are from year 2000 for all the cultivars.

Table 3. Observed and simulated values of different parameters during calibration.

S.N.	Parameter	Year	Cultivar		
			Macia	Sima	Pato
1	Days to 50% flowering	Observed	71	77	79
		Simulated	70	77	79
3	Days to physiological maturity	Observed	110	115	117
		Simulated	112	115	117
5	Grain yield (kg/ha)	Observed	1380	970	970
		Simulated	1383	970	966

2.5 Simulation of different Management Practices

The effect of different plant population and fertiliser rates along with some other crop management practices on sorghum yield was explored using the simulation exercises in APSIM. Farmers in Dodoma region grow sorghum with a row spacing of 75 cm and plant to plant distance of 15 cm, giving a total plant population of 88,888 plants ha^{-1}. They do not apply any fertiliser at sowing or thereafter.

v. Plant population

Six treatments of plant populations were simulated *viz.* 37,000 (90 x 30 cm), 44,444 (75 x 30 cm), 55,555 (60 x 30 cm), 74,000 (90 x 10 cm), 88,888 (75 x 15 cm) and 11,111 (60 x 10 cm) plants ha^{-1} for all the 3 sorghum cultivars. For the Macia cultivar, the average yield (from 11 years) increases with increase in plant population. For the low plant population of 37,000 plants ha^{-1} the crop yield in more than 80% years is actually close to zero while for 44,000 plants ha^{-1} it is very low compared to other higher plant population. Highest average yield is achieved with a plant population of 11,111 plants ha^{-1} (Fig. 1a). The probability distribution shows that the higher plant population gives higher yield in all the years (Fig. 1b) with the highest yield achieved for 11,111 plants ha^{-1} in each of the 11 years.

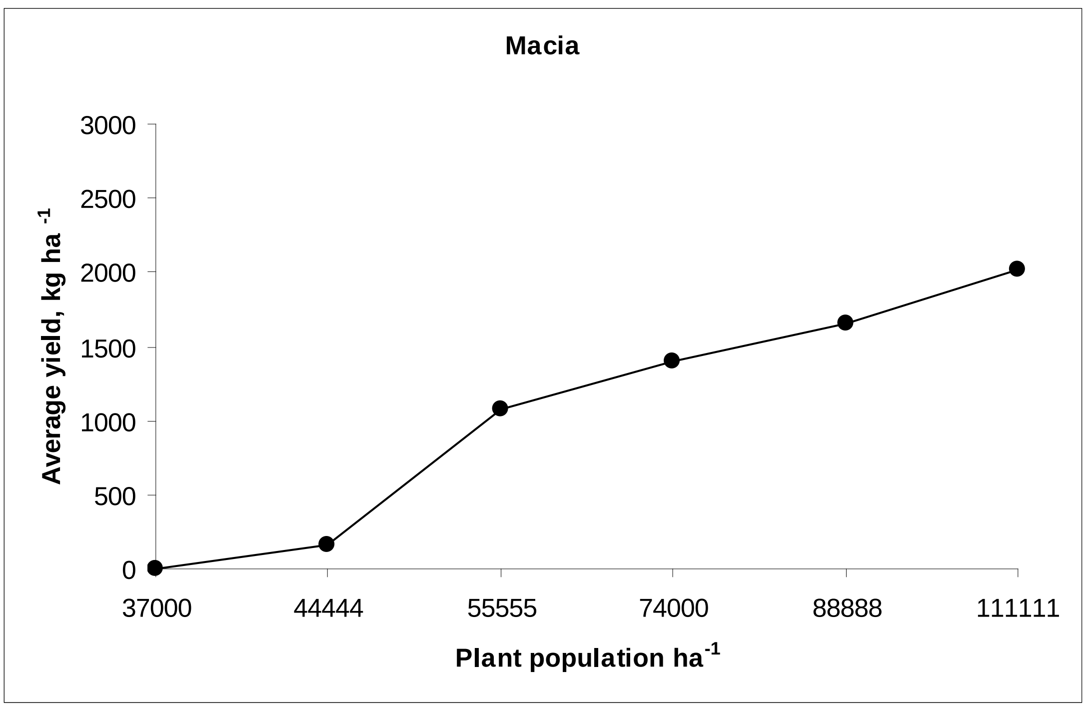

Figure 1a. Effect of plant population on yield of sorghum for Macia cultivar.

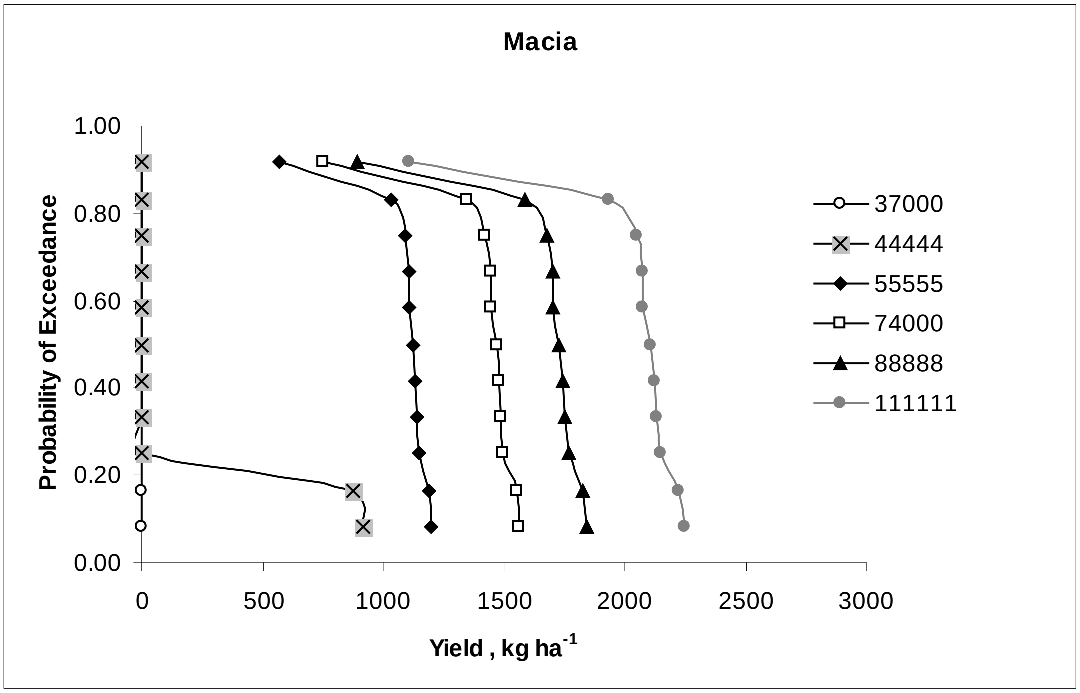

Figure 1b. **Probability distribution of simulated sorghum yield (Macia) for different plant population.**

Hence having a higher plant population does have an advantage and farmers can expect higher yield by planting Macia cultivar at a row spacing of 60 cm and 15 cm plant to plant spacing. However, the farmers in the region choose a row spacing of 75 cm giving the next best plant population *i.e.,* 88,888 plants ha^{-1}. Perhaps this row spacing gives them a chance to either have intercropping or better workability for intercultural operations. Hence, for the purpose of seeing the effect of fertiliser and other management practices, farmers' preferred plant population of 88,888 plants ha^{-1} has been selected for Macia cultivar. However, a plant population of 11,111 plants ha^{-1} *i.e.* a row spacing of 60 cm and a plant to plant spacing of 15 cm can be recommended for Macia in Dodoma.

For a low yielding cultivar (Sima), also, the higher plant population gives a higher yield (Fig.2a), and a plant population of 11,111 plants ha^{-1} gives the best results. Hence it can be recommended for this cultivar.

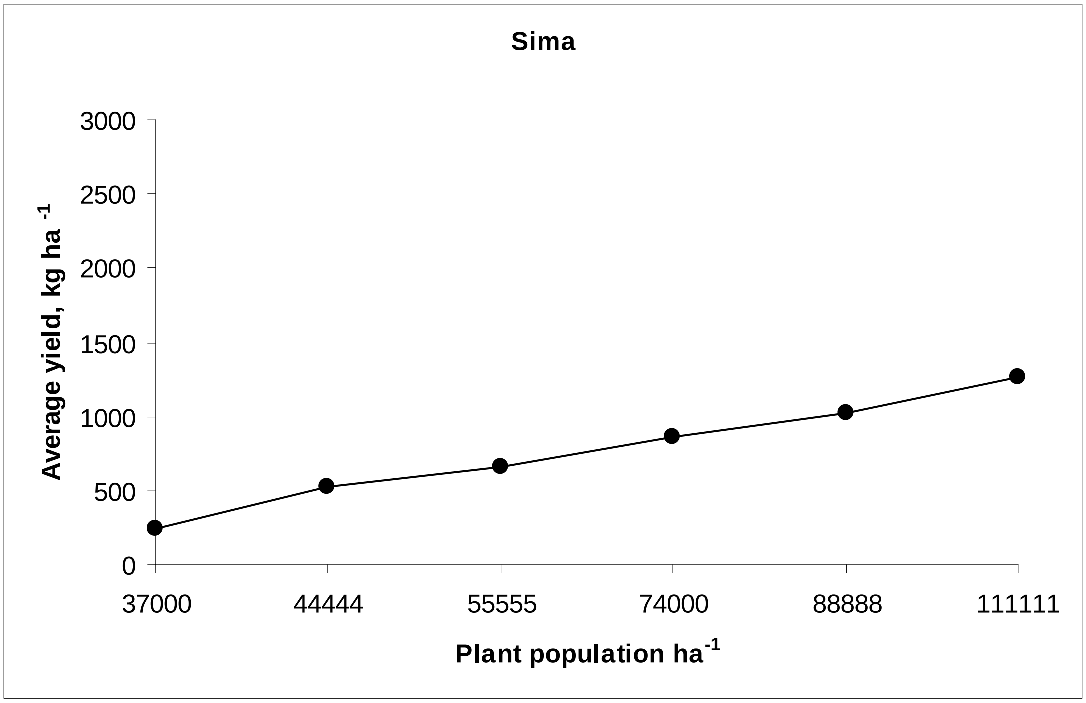

Figure 2a. Effect of plant population on yield of sorghum for Sima cultivar.

The farmers' practice of choosing a plant population of 88,888 plants ha^{-1} may pose some disadvantage in this environment. However for the purpose of seeing the effect of fertiliser and other management practices, farmers' preferred plant population of 88,888 plants ha^{-1} has been selected for Sima cultivar. The probability distribution (Fig. 2b) shows that the higher plant population gives substantially higher yield in all the 11 years.

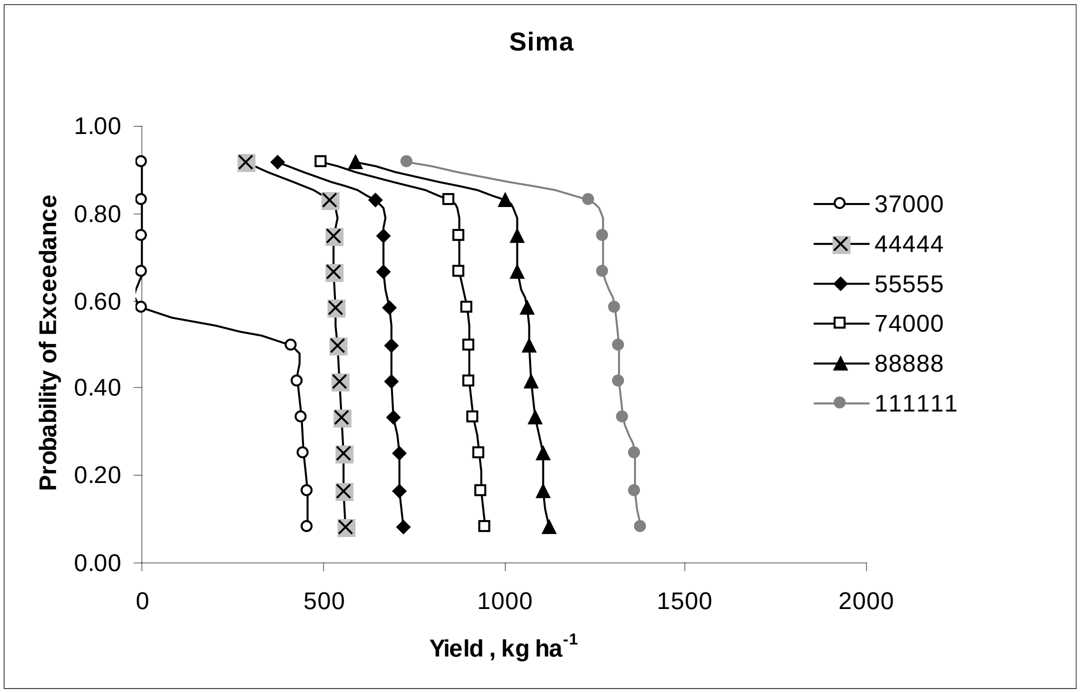

Figure 2b. **Probability distribution of simulated sorghum yield (Sima) for different plant population.**

For another low yielding cultivar Pato, also the higher plant population gives higher yield (Fig. 3a) and the probability distribution (Fig. 3b) also shows that farmers can achieve higher yield in all the years by having higher plant population, the best being 11,111 plants ha^{-1}.

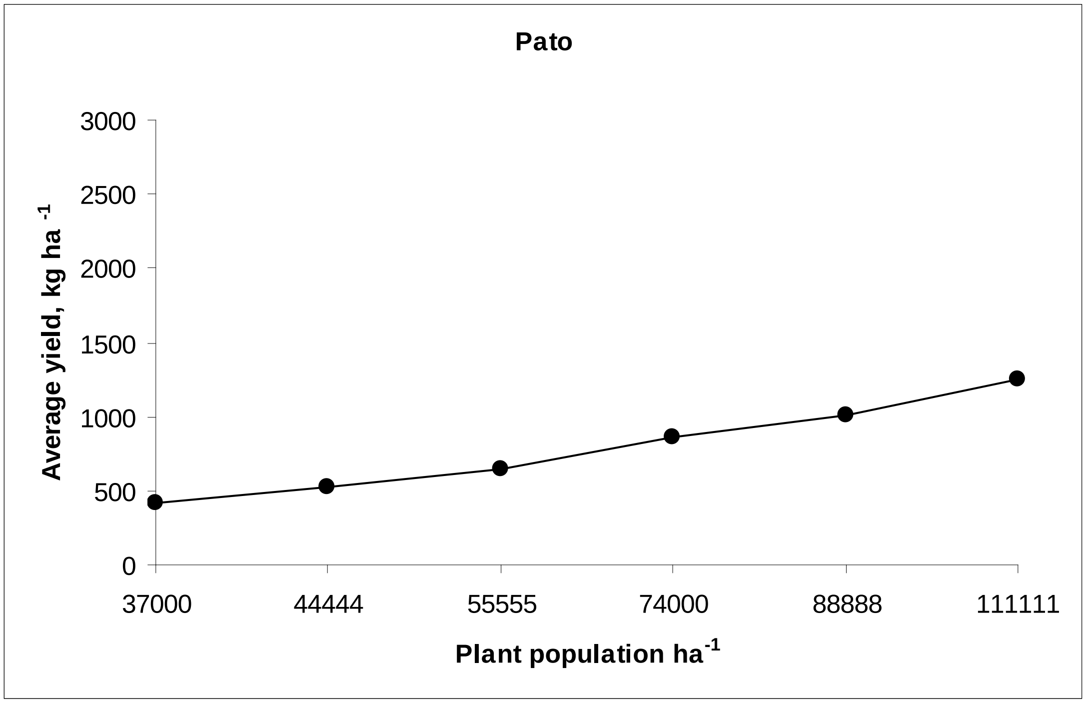

Figure 3a. **Effect of plant population on yield of sorghum for Pato cultivar.**

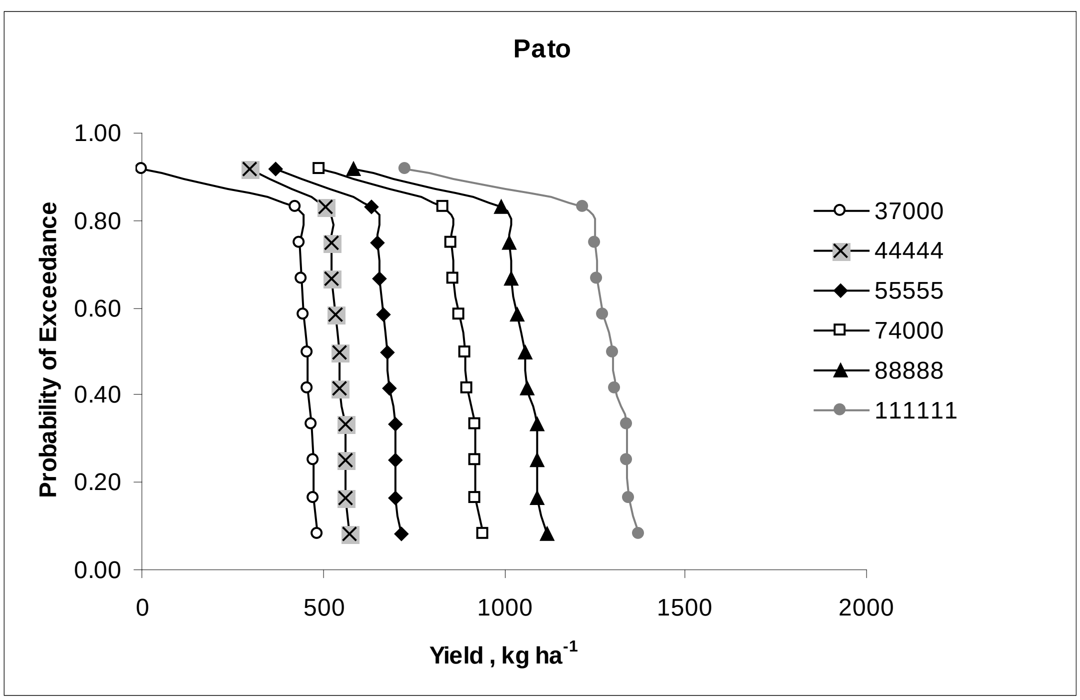

Figure 3b. **Probability distribution of simulated sorghum yield (Pato) for different plant population.**

vi. Fertiliser rates

There were five different fertiliser rates used to simulate the effect of fertiliser on sorghum yield of different cultivars. These were:

1. Farmers' practice (FP) *i.e.*, 0 kg ha^{-1}
2. FP + 30N, means basal application with 30 kgN ha^{-1}at sowing.
3. FP + 60N, means basal application with 30 kgN ha^{-1}at sowing + top dressing with 30 kgN ha^{-1} after 3 weeks.
4. FP + 90N means basal application with 30 kgN ha^{-1}at sowing + top dressing with 60 kgN ha^{-1} after 3 weeks.
5. FP + 120N means basal application with 30 kgN ha^{-1}at sowing + top dressing with 90 kgN ha^{-1} after 3 weeks.

The probability distribution of grain yield for different fertiliser rates for Macia cultivar (Figure 4a) shows that the grain yield increased with the application of fertiliser. The increase in grain yield is similar for 30 and 60 kgN ha^{-1}, and both treatments give almost same yield. In the same way the increase in grain yield is similar for 90 and 120 kgN ha^{-1}, and both treatments also give almost same yield, that is why only 3 lines are visible in the graph. There is definite yield gain from 30 kgN ha^{-1} application compared to no fertiliser application. However, beyond 30 kgN ha^{-1}, there seems to be no significant yield gain. Hence, if economically viable the recommended fertiliser application for this cultivar in Dodoma is 30 kgN ha^{-1}.

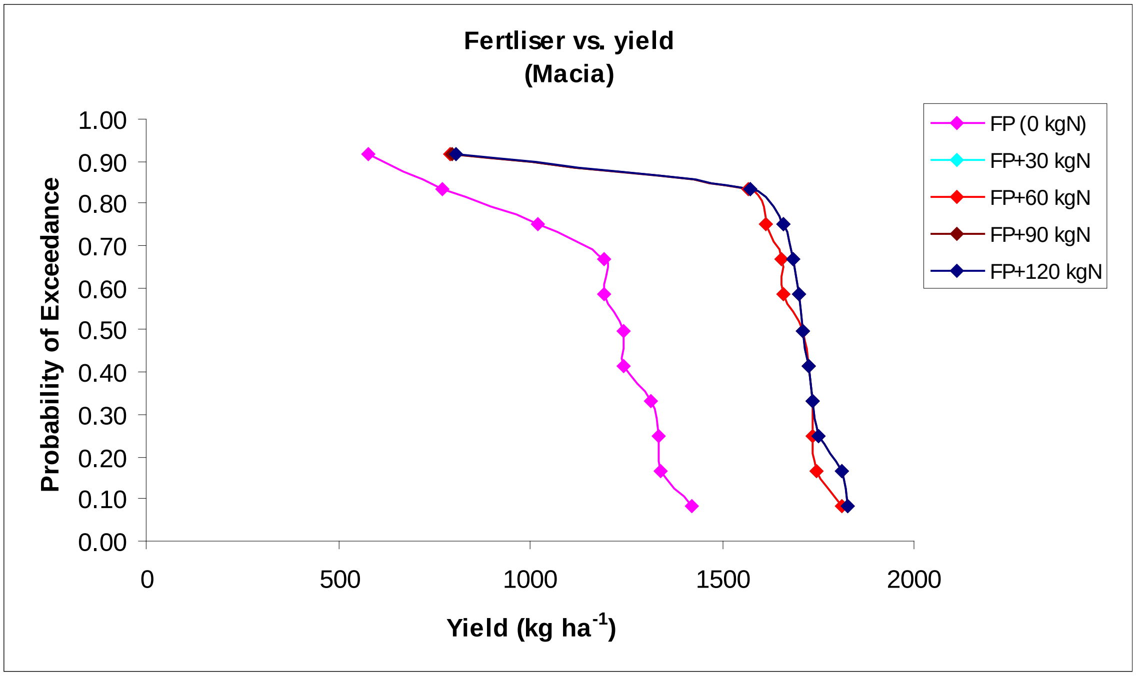

Figure 4a. **Probability distribution of simulated sorghum yield (Macia) for different fertiliser application rates.**

In the case of Sima cultivar, the probability distribution (Fig. 4b) shows that the yield is increased when the 30 kgN ha^{-1} is applied, however beyond that no yield gain is observed for increase in fertiliser, that is why the graph shows only 2 lines as yields corresponding to 30, 60, 90 and 120 kgN ha^{-1} almost overlap. Hence, if economically viable the recommended fertiliser application for this cultivar in Dodoma is also 30 kgN ha^{-1}.

Pato is another cultivar which is similar to Sima and it also gave the similar results as Sima. Only the 30 kgN ha^{-1} increased the yield and no further increase in yield is obtained by increasing fertliser (Fig. 4c). Hence, if economically viable the recommended fertiliser application for this cultivar in Dodoma is also 30 kgN ha^{-1}.

The simulated grain yields in 11 years for these fertilizer treatments are given in Table A in Appendix.

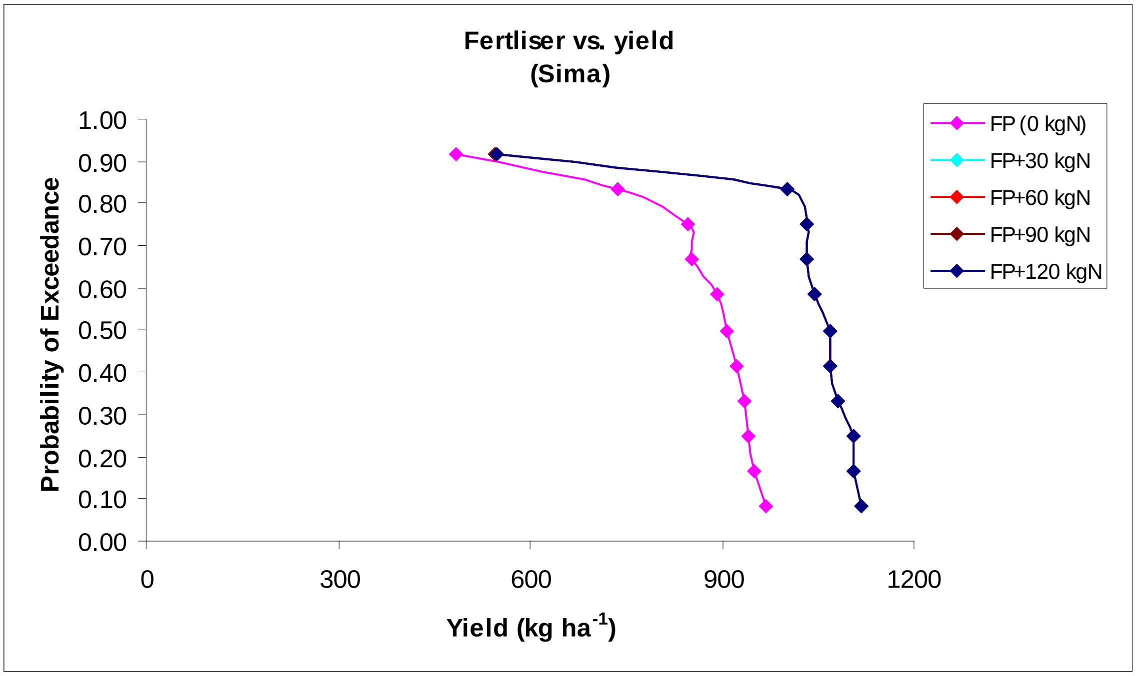

Figure 4b. **Probability distribution of simulated sorghum yield (Sima) for different fertiliser application rates.**

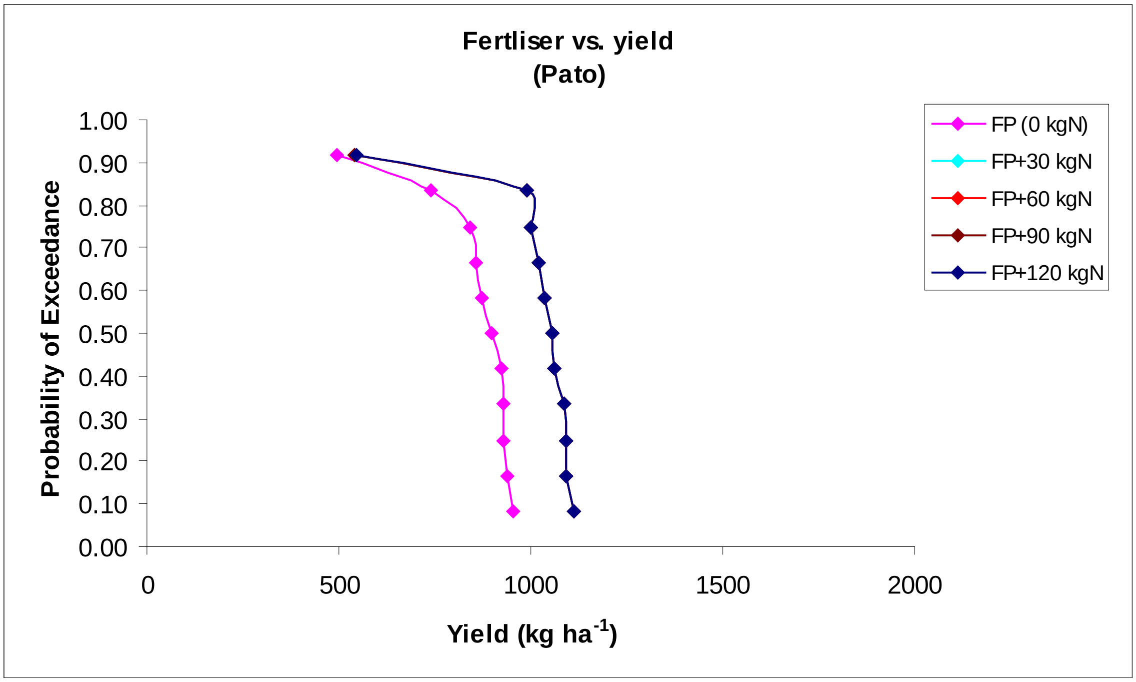

Figure 4c. **Probability distribution of simulated sorghum yield (Pato) for different fertiliser application rates.**

vii. Effect of Tied ridge and Mulching on yield

For the simulation of farmers' practice a curve number of 80 was used in APSIM. The effect of tied ridge was simulated by decreasing the curve number by a value of 8 hence reducing the runoff and providing the soil more amount of moisture. However, for the Macia cultivar the tied ridge does not provide any advantage rather it reduces the grain yield a little bit especially when fertiliser is applied (Figure 5a). It can happen due to less runoff from the field which in turn affects the infiltration and might cause leaching of nutrients.

The effect of mulching was simulated by setting a 2500 kg ha^{-1} of the sorghum residue in the field. Mulching reduces the runoff; however it can also provide the organic matter which decomposes and provides some nitrogen to the standing crop. From the Fig. 5a, it can be seen that the mulching also does not increase the grain yield. It follows the above results of fertiliser application when the higher fertiliser rates do not increase yield. Sometimes yield is reduced by a very small amount which can be due to the effect of tied ridge as explained above. The combination of mulching and tied ridge also reduces the yield little bit due to the effect of tied ridge and mulching. Hence both tied ridge and mulching practices and their combination thereof do not help in increasing yield in this environment for this cultivar. Hence these practices are not recommended.

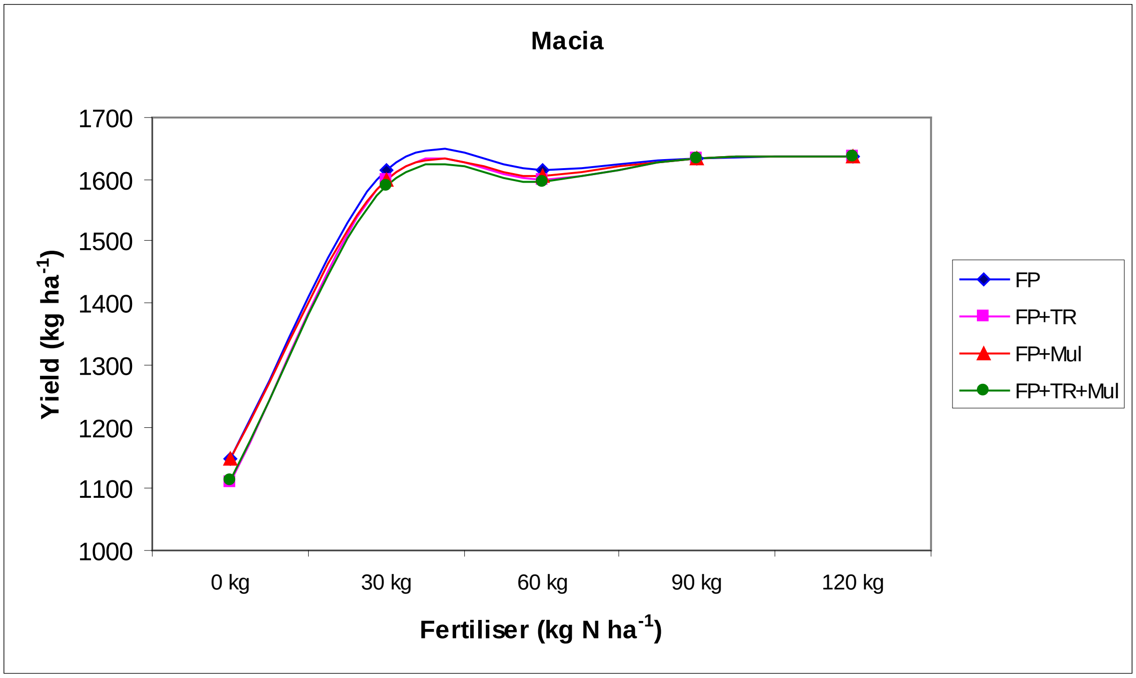

Figure 5a. **Effect of farmers' practice (FP), tied ridge (TR), mulching (Mul) and their combination on yield of sorghum (Macia).**

For the Sima cultivar, there is no significant effect of either tied ridge or mulching or their combination thereof (Fig. 5b). Hence the farmers can continue to use their traditional practice for this cultivar.

For the Pato cultivar, also the results are similar to Sima cultivar and either tied ridge or mulching or their combination thereof does not increase any yield (Fig.5c). Hence the farmers can continue to use their traditional practice for this cultivar also.

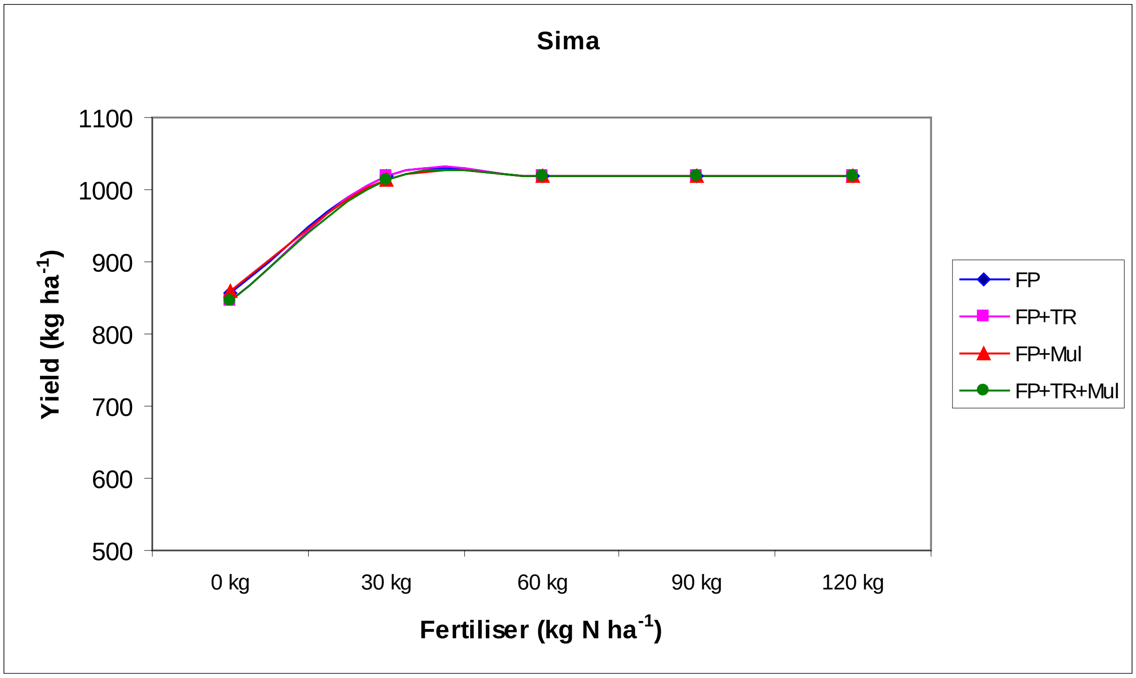

Figure 5b. **Effect of farmers' practice (FP), tied ridge (TR), mulching (Mul) and their combination on yield of sorghum (Sima).**

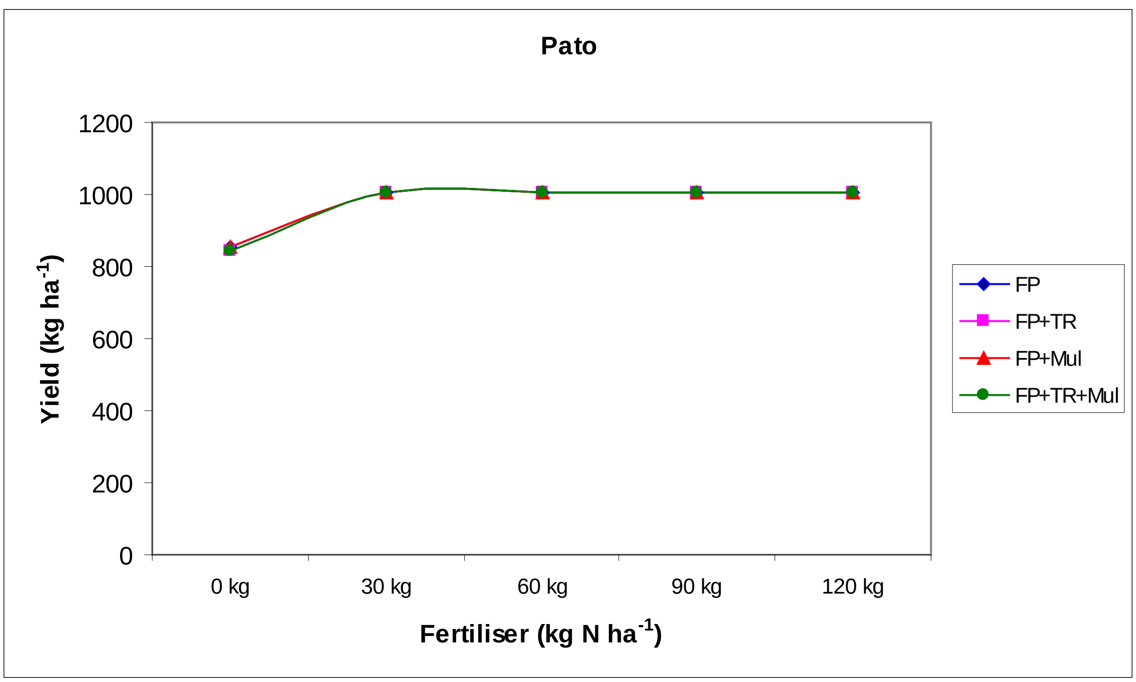

Figure 5c. **Effect of farmers' practice (FP), tied ridge (TR), mulching (Mul) and their combination on yield of sorghum (Pato).**

viii. Effect of Intercropping

When the intercropping is practiced with a short duration variety of pigeonpea (PP) with a row spacing of 1 m and plant to plant distance of 50 cm (to give a plant population of 20,000 plants ha^{-1}) along with the Macia sorghum cultivar, there is substantial yield loss of sorghum at 30 kgN ha^{-1} compared to farmers' practice because while intercropping the sorghum yield did not increase by applying 30 kgN ha^{-1} fertiliser, rather it increased when 60 kgN ha^{-1} or higher fertiliser was applied (Fig. 6a). Although there was some grain yield of pigeonpea. However, the partial budget analysis would provide the extent of economic benefit because farmers have to invest in pigeonpea seeds. As there were no yield benefits with tied ridge, mulching or their combination, the intercropping was only done with farmers' practice (FP).

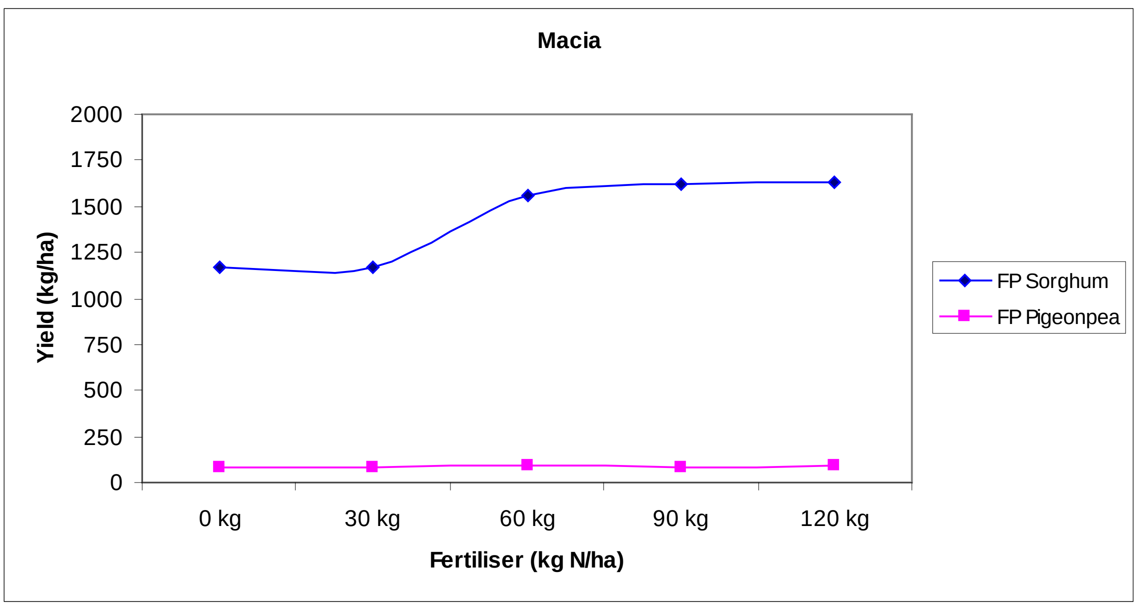

Figure 6a. Effect of intercropping with pigeonpea with farmers' practice (FP) on yield of sorghum (Macia).

When the intercropping of is pigeonpea is done with the Sima sorghum cultivar, the results are similar to Macia except that the increase in yield is less pronounced when fertilizer is increased from 30 kgN ha^{-1} to 60 kgN ha^{-1}. However the increase in pigeonpea yield was higher than Macia (Figure 6b).

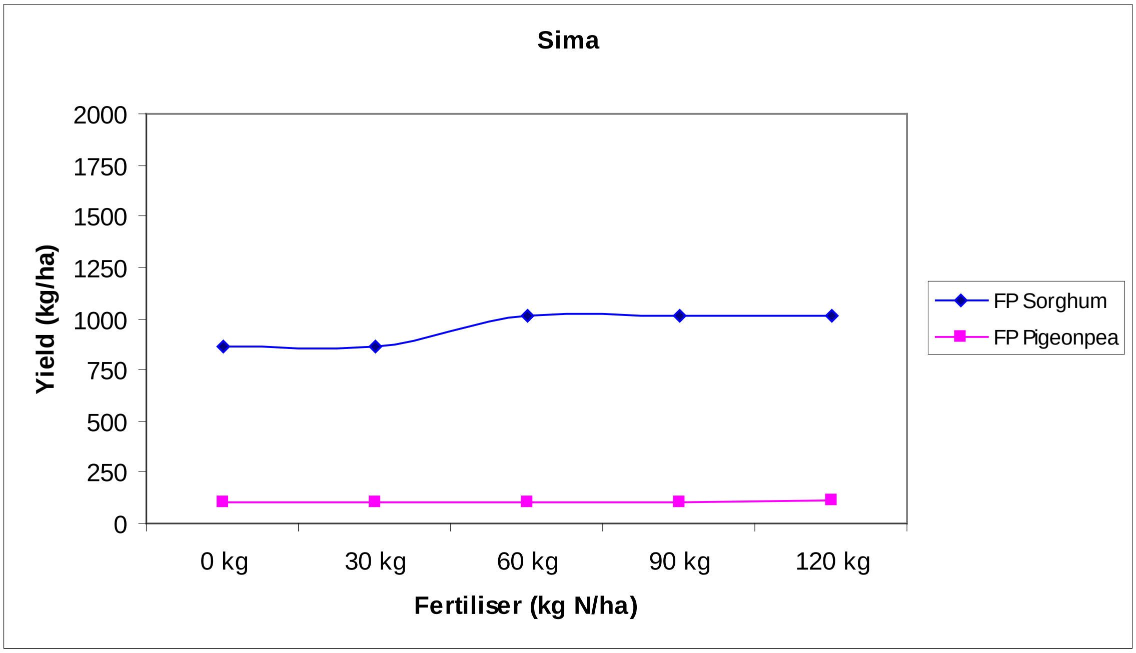

Figure 6b. **Effect of intercropping with pigeonpea with farmers' practice (FP) on yield of sorghum (Sima).**

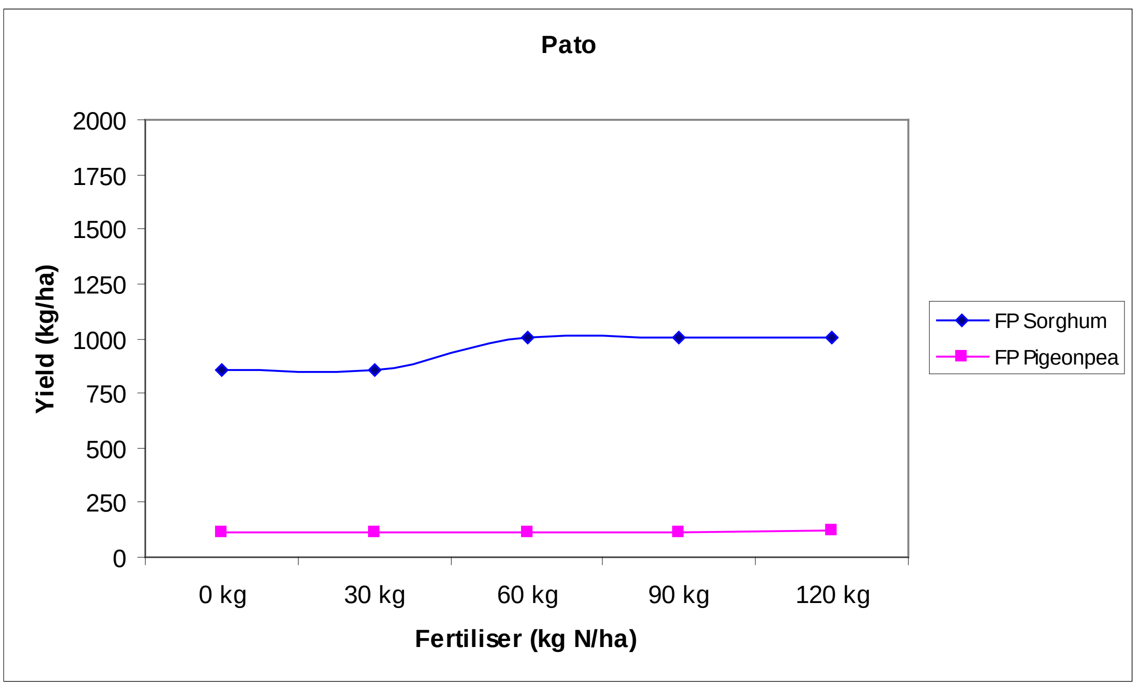

Figure 6c. **Effect of intercropping with pigeonpea with farmers' practice (FP) on yield of sorghum (Pato).**

When the intercropping of is pigeonpea is done with the Pato sorghum cultivar, the results were similar to that of Sima cultivar because Pato seems to be a similar cultivar as Sima. The pigeonpea grain yield was higher than Macia but lower than Sima (Fig. 6c).

2.6 Partial Budgeting

The partial budgeting analysis was performed for all the sorghum cultivars for the different fertiliser application rates and intercropping combined with different fertiliser rates. The yield gain per kg N applied was calculated thereafter the cost of fertiliser and profit from corresponding yield gains were determined to give rate of return for particular fertiliser treatment. Subsequently the percentage (%) of years exceeding a rate of return (RR) of 1.0, 1.5 and 2.0 were calculated. The price of Urea, Sorghum and Pigeonpea in Dodoma was Tsh 840, Tsh 242 and Tsh 800/kg. To do intercropping the farmers have to purchase pigeonpea seeds which was priced at Tsh 1571/kg. The ratio of sale price of pigeonpea and sorghum is more than 3.25 and including the cost of pigeonpea seed a ratio of 3.0 was taken to calculate rate of return. The partial budgeting with tied ridge, mulching and their combination was not performed because these practices were not found to be useful for these cultivars in Dodoma.

The following Tables shows the rate of return of different practices for **Macia, Sima** and **Pato** cultivars.

Looking at the partial budgeting analysis for Macia (Table 4a), it looks like the safest and best practice is to apply 30 kgN ha^{-1} and follow all other usual practices. It guarantees the farmers a rate of return of more than 1.0 in 100% of the years while a rate of return of 1.5 in 73% of the years. Intercropping with the pigeonpea is not very beneficial and there is a risk involved. However if the farmers' could afford the price of intercropping and 60 kgN ha^{-1} then they can get a rate of return of more than 1.5 in 55% of the years. Nevertheless it involves risk.

Table 4a. Average, maximum, minimum yield of sorghum with different practices along with their rate of return for Macia

	FP (0N)	FP+30N	FP+60N	FP+90N	FP+120N	FP+PP (0N)		FP+PP +30N		FP+PP +60N		FP+PP +90N		FP+PP +120N	
						Sorg.	PP	Sorg.	PP	Sorg.	PP	Sorg.	PP	Sorg.	PP
Average Yield (kg/ha)	1150	1614	1614	1635	1636	1168	86	1168	86	1560	88	1618	87	1626	88
Best Yield (kg/ha) (Maximum)	1419	1811	1811	1825	1826	1386	116	1386	116	1744	120	1826	120	1826	120
Worst Yield (kg/ha) (Minimum)	579	793	793	797	805	575	56	575	56	694	56	732	56	764	56
% years with value to cost ratio > 1		100	0	0	0	100		64		73		55		18	
% years with value to cost ratio > 1.5		73	18	0	0	0		9		55		9		0	
% years with value to cost ratio > 2		45	0	0	0	0		0		9		0		0	

PP = Intercropping with pigeonpea

Table 4b. Average, maximum, minimum yield of sorghum with different practices along with their rate of return for Sima

	FP (0N)	FP+30N	FP+60N	FP+90N	FP+120N	FP+PP (0N)		FP+PP +30N		FP+PP +60N		FP+PP +90N		FP+PP +120N	
						Sorg.	PP	Sorg.	PP	Sorg.	PP	Sorg.	PP	Sorg.	PP
Average Yield (kg/ha)	858	1018	1018	1018	1019	859	105	859	105	1012	108	1017	107	1017	108
Best Yield (kg/ha) (Maximum)	968	1117	1117	1117	1117	936	137	936	137	1117	142	1117	142	1118	142
Worst Yield (kg/ha) (Minimum)	484	544	544	545	548	481	74	481	74	529	74	534	74	540	74
% years with value to cost ratio > 1		9	0	0	0	100		91		73		0		0	
% years with value to cost ratio > 1.5		0	0	0	0	0		45		0		0		0	
% years with value to cost ratio > 2		0	0	0	0	0		0		0		0		0	

PP = Intercropping with pigeonpea

Table 4c. Average, maximum, minimum yield of sorghum with different practices along with their rate of return for Pato

	FP (0N)	FP+30N	FP+60N	FP+90N	FP+120N	FP+PP (0N)		FP+PP +30N		FP+PP +60N		FP+PP +90N		FP+PP +120N	
						Sorg.	PP	Sorg.	PP	Sorg.	PP	Sorg.	PP	Sorg.	PP
Average Yield (kg/ha)	853	1007	1007	1007	1008	857	113	857	113	1001	118	1005	117	1005	118
Best Yield (kg/ha) (Maximum)	954	1114	1114	1114	1114	943	142	943	142	1089	151	1114	151	1114	155
Worst Yield (kg/ha) (Minimum)	496	541	541	543	546	489	82	489	82	528	82	531	82	537	82
% years with value to cost ratio > 1		9	0	0	0	100		100		73		0		0	
% years with value to cost ratio > 1.5		0	0	0	0	0		55		0		0		0	
% years with value to cost ratio > 2		0	0	0	0	0		0		0		0		0	

PP = Intercropping with pigeonpea

For the Sima cultivar, the best practice can be either the farmer's practice or intercropping with pigeonpea with 30 kgN ha^{-1} to give a rate of return of more than 1.0 in 91% of the years and more than 1.5 in almost half of the years (Table 4b). However with this practice some risk is involved.

For the Pato cultivar, the best practice is intercropping with pigeonpea with 30 kgN ha^{-1}. It guarantees a rate of return of more than 1.0 in 100% of the years and more than 1.5 in 55% of the years (Table 4c). There is no risk involved in this practice.

2. Recommendations

(i) **Macia :-** Farmers' practice with 30 kgN ha^{-1}

(ii) **Sima :-** Intercropping with pigeonpea with 30 kgN ha^{-1}

(iii) **Pato :-** Intercropping with pigeonpea with 30 kgN ha^{-1}

Appendix

Table A. Simulated response of different fertiliser rates on grain yield of different sorghum cultivars in 11 years.

Year	Grain Yield (kg/ha)														
	Macia					Sima					Pato				
	FP (0 kgN)	FP+30 kgN	FP+60 kgN	FP+90 kgN	FP+120 kgN	FP (0 kgN)	FP+30 kgN	FP+60 kgN	FP+90 kgN	FP+120 kgN	FP (0 kgN)	FP+30 kgN	FP+60 kgN	FP+90 kgN	FP+120 kgN
1997	1193	1748	1748	1810	1812	950	1107	1107	1107	1107	954	1114	1114	1114	1114
1998	1334	1735	1735	1737	1737	940	1080	1080	1080	1080	941	1091	1091	1091	1091
1999	579	793	793	797	805	484	544	544	545	548	496	541	541	543	546
2000	1419	1724	1724	1724	1724	968	1044	1044	1044	1044	929	998	998	998	999
2001	1022	1811	1811	1825	1826	936	1117	1117	1117	1117	930	1086	1086	1086	1086
2002	1338	1712	1712	1713	1713	906	1070	1070	1070	1070	897	1061	1061	1061	1061
2003	1313	1660	1660	1687	1687	892	1033	1033	1033	1034	874	1019	1019	1019	1019
2004	1193	1655	1655	1662	1662	854	1033	1033	1033	1033	858	1055	1055	1055	1055
2005	1242	1738	1738	1752	1752	923	1105	1105	1105	1105	925	1089	1089	1089	1089
2006	1241	1566	1566	1576	1576	847	1002	1002	1002	1002	843	988	988	988	988
2007	771	1615	1615	1698	1699	736	1068	1068	1068	1068	738	1035	1035	1035	1035

FP= Farmer’s Practice