

## INTERCROPPING OF FORAGE LEGUMES IN GRAIN SORGHUM AND THEIR RESIDUAL EFFECT ON WHEAT.

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### ABSTRACT

Field experiments were conducted at Tamil Nadu Agricultural University Farm, Coimbatore for three years from 1985 to 1988 to study the performance of forage legumes in grain sorghum as inter crops and their residual effect on the subsequent wheat crop. The results revealed that sword bean and greengram markedly affected the sorghum grain yield. Sword bean was the best suited intercrop for fodder yielding 6.13 t.ha<sup>-1</sup> and it out yielded the other forage legumes. Highest net return and B : C ratio were obtained when sorghum was intercropped with sword bean and cowpea. Fodder value of cowpea was the highest with the crude protein content of 28.76 percent. Sorghum intercropped with forage legumes produced significantly higher grain yield of succeeding wheat over sole crop of sorghum.

**KEYWORDS :** Sorghum, Intercropping, Forage legume, wheat, Residual Effect.

The unique ability of the legumes in enriching the soil fertility through N fixation and enhanced crop yields of the associated non legumes is well established (Ruschel *et al.* 1979). Increased yields of sorghum due to intercropping of greengram, soybean and cowpea (Singh 1977) and with lab-lab (Chamy 1977) have been reported. The residual effect of legumes on the succeeding crops were well documented (Searle *et al.* 1981 and Sanjoy *et al.* 1986). The information on the performance of forage legumes in irrigated grain sorghum and their residual effect on the succeeding crops are rather limited. Hence studies were conducted to identify suitable forage legumes for intercropping with grain sorghum and to assess their residual effect on the succeeding wheat crop.

### MATERIAL AND METHODS

Field trails were carried out at the Millet Breeding Station Farm, Tamil Nadu Agricultural University, Coimbatore during Kharif and Rabi season of 1985-1986, 1986-1987 and 1987-1988 under irrigated conditions. The soil of the experimental field was clay loam with available nutrient status of low nitrogen, me-

dium phosphorus and high potassium. Sorghum with forage legumes as intercrops during *Kharif* as the main crop and wheat during *rabi* as residual crop were raised during all the three years of the study. The treatments during *Kharif* comprised of five cropping system viz. Sorghum intercropped with cowpea (CO 5), soybean (CO 1), greengram (CO 4) and sword-bean and sorghum as sole crop. The treatments were laid out in a randomised block design with four replications. Sorghum was raised in paired row system of 30-90 X 10 cm. Two rows of legumes were raised in the interspace of 90 cms between two pairs of sorghum. A uniform dose of 80:40:40 kg.ha<sup>-1</sup> NPK. was applied. The entire P and K and half of N as basal at the time of sowing and remaining half the dose of N at 35 days after planting as top dressing were applied. Sowings were taken on 11th July 1985, 18th July, 1986 and 3rd July, 1987. The legumes were harvested for fodder at the age of 60 days and sorghum for grain on 18th July, 1986 and 3rd July, 1987. The legumes were harvested for fodder at the age of 60 days and sorghum for grain on 18th October 1985, 10th November, 1986 and 20th October 1987 respectively. After the harvest of sorghum, the individual plots were

prepared without altering the layout. Wheat (HD 2189) was raised in solid rows placed 22.5 cm apart on 3rd December 1985, 17th December 1986 and 23rd November 1976 as residual crop under irrigated conditions. The yield of legumes for fodder on fresh weight basis and the grain and straw yield for sorghum and grain yield of wheat were recorded. The total N content in forage legumes was estimated by Micro-Kjeldahl method (Humphries 1956) and crude protein content was computed by multiplying the N content with factor 6.25. The data were analysed statistically. The mean gross, net returns and benefit-cost ratio (B: C ratio) were worked out.

## RESULTS AND DISCUSSION

### *Direct effect of legumes on grain sorghum*

The sole crop of sorghum produced the maximum grain yield in all the three years of study (Table 1). The intercropped forage legumes affected the mean grain yield of sorghum over three years when compared to sole sorghum. However the grain yield of sorghum was not affected by intercropping during 1987. Among the intercrops greengram affected the grain yield adversely whereas the effect was least with soybean.

The straw yield was maximum in pure stand of sorghum. Though intercropping reduced the sorghum straw yields appreciably the effect was more with green gram and swordbean intercropping systems. The straw yield was higher in sorghum + cowpea systems than the sole sorghum during 1986 and the effect of other intercrops were not realised.

Among the intercrops, swordbean produced highest mean green fodder than the other legumes (6133 kg.ha<sup>-1</sup>). Fodder production was least with soybean (2671 kg.ha<sup>-1</sup>). The trend was noticed during all the three years of study. The vigorous growth of swordbean from the beginning may be advantageously utilised for increased

fodder production when compared with other legumes. Considering the fodder value, cowpea produced quality fodder with higher crude protein content (28.76%) followed by greengram. Though fodder yield was maximum in swordbean, the crude protein content was minimum (23.10%).

The economics of different cropping systems revealed that intercropping sorghum with forage legumes is profitable than sole cropping (Table 2). Sorghum grown with cowpea and swordbean resulted in higher net-returns than soybean and greengram. Cowpea and swordbean systems increased the net returns by 20.8 per cent over sole cropping. The same trend was reflected in B: C ratio too. Sorghum with swordbean and cowpea systems achieved the B: C ratio of 2.05 while it was 1.93 with sole cropping.

### *Residual effect of forage legumes on wheat*

The mean grain yield of wheat (Table 3) indicated that all the intercropped forage legumes have a positive and beneficial residual effect on the subsequent wheat crop. The grain yield of wheat was minimum in plots raised without intercrops. The grain yield of wheat was maximum (2022 kg.ha<sup>-1</sup>) when the preceding sorghum crop was raised with swordbean. The increments of wheat grain yield due to intercropping with legumes in the previous season ranged from 14.3 to 24.2 per cent over sole sorghum. Though the legumes fixed the atmospheric N in their root nodules, the beneficial effect may be realised in the subsequent crop rather than in the associated base crop. These results are in line with the findings of Sanjoy *et al.* (1986) who observed residual effect of legumes on succeeding wheat. It was concluded that legumes for fodder especially swordbean and cowpea may be included as intercrops in sorghum for maximum returns. Inclusion of these legumes could produce beneficial residual effect on the productivity of succeeding crops like wheat.

Table 1. Sorghum grain and straw yield (kg.ha<sup>-1</sup>)

Cropping Systems	Sorghum grain yield (kg.ha <sup>-1</sup> )					Sorghum straw yield (kg.ha <sup>-1</sup> )				
	1985	1986	1987	Pooled Mean	1985	1986	1987	Pooled Mean		
1. Sole Sorghum	3,465	4,849	4,594	4,303	9,090	7,815	8,174	8,360		
2. Sorghum + Fodder cowpea (Co.5)	3,324	4,750	4,479	4,184	8,426	8,019	7,333	7,926		
3. Sorghum + Fodder soybean (Co.1)	3,337	4,767	4,499	4,201	7,972	7,952	7,839	7,921		
4. Sorghum + Fodder green-gram (Co.4)	2,441	4,742	4,371	3,851	7,469	7,778	7,826	7,691		
5. Sorghum + Fodder sword bean	2,632	4,682	4,560	3,958	7,477	7,889	7,871	7,746		
SEd	171	54	140	98	129	136	85	143		
CD (5%)	348	113	N.S	201	263	N.S	178	292		

Table 2. Intercrop green fodder yield (kg.ha<sup>-1</sup>) and Economics

Cropping system	Intercrop green fodder Yield (kg.ha <sup>-1</sup> )			Mean crude protein content of forage legume (%)	Return (Rs.ha <sup>-1</sup> )		B : C Ratio
	1985	1986	1987		Gross	Net	
	Mean						
1. Sole Sorghum	—	—	—	—	9,681	4,681	1.93
2. Sorghum + Fodder cowpea	4,795	4,311	4,959	28.76	11,055	5,655	2.05
3. Sorghum + Fodder soybean	3,261	7,793	2,860	25.95	10,493	5,093	1.94
4. Sorghum + Fodder Green gram	6,359	2,967	5,228	27.98	10,363	4,963	1.92
5. Sorghum + Fodder sword bean	7,720	5,619	5,060	23.10	11,052	5,652	2.05
SEd	382	123	486	0.56			
CD (5%)	795	257	1,011	1.16			

Table 3. Residual effect of intercropped forage legumes on wheat grain (kg.ha<sup>-1</sup>)

Cropping systems	Grain yield (kg.ha <sup>-1</sup> )			Pooled Mean	% increase over sole sorghum
	1985-1986	1986-1987	1987-1988		
1. Sole sorghum	1,134	1,756	1,995	1,628	—
2. Sorghum + Forage cowpea	1,213	1,929	2,444	1,861	14.3
3. Sorghum + Forage soybean	1,244	1,941	2,564	1,915	17.6
4. Sorghum + Forage greengram	1,182	1,992	2,596	1,924	18.2
5. Sorghum + Forage swordbean	1,238	2,073	2,800	2,022	24.2

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**EFFECT OF IRRIGATION AND FERTILITY LEVELS ON NUTRIENT CONTENT, UPTAKE AND RECOVERY IN RABI MAIZE.**

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ABSTRACT

Experiments at Banaras Hindu University, Varanasi (U.P.) on *rabi* maize during 1985-1986 and 1986-1987 revealed that N and K<sub>2</sub>O content of plants (shoot + leaves) increased with increasing irrigation levels but decreased with advancement in age of crop. The P<sub>2</sub>O<sub>5</sub> content was lower at higher irrigation levels as compared to lower irrigation levels and the P<sub>2</sub>O<sub>5</sub> content increased with advancement in age of crop. Uptake and recovery of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O increased with increasing levels of irrigation.

KEYWORDS: Maize, Irrigation levels, Fertility level, Uptake, Recovery.

Poor water supply or excessive irrigation will result in unavailability or leaching of a major part of nutrients resulting in the deficiency of these nutrients and low yields. Proper water control will hold these losses to a minimum. Similarly the availability of nutrients to plant

roots was also influenced by the amount and movement of water in soil. Keeping these facts in view, the present study was undertaken to find out the effect of different irrigation (IW/CPE ratios) and fertility levels on the content, uptake and recovery of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O by *rabi* maize.