Table 1. Callus induction and regenetation percentage in different media.

	Med.1	Med.2	Med.3	Med.4
No. of days for C.I.	20	24	27	30
No. of days for C.P. from the day of callus induction	15	20	23	27
C.I. %	60	55	57	51
Multiple shoot initiation %	37	30	28	27
Regeneration %	36	29	25	23

C.I. : Callus initiation
C.P. : Callus proliferation
Med.1 : MS + kinetin (1.0 mg/l) + IAA (1.5 mg/l)
Med.2 : MS + NAA (1.0 mg/l) + kinetin (1.0 mg/l) + adenine (40.0 mg/l)
Med.3 : MS + IAA (2.0 mg/l) + kinetin (1.0 mg/l)
Med.4 : LS + NAA (2.0 mg/l) + kinetin (1.0 mg/l)

Plant regeneration from callus derived somatic embryoids has been previously reported from cotton c.v. Coker -30 (Davidonis and Hamilton, 1983). However, these were reported to have developed only after two years in culture. In contrast, the regeneration reported by Shoemaker *et al.* (1986) is simple straight forward and rapid and conducive to most cotton improvement programmes, requiring plant regeneration from tissue culture. The regeneration of cotton plant form callus reported here is also very simple. Embryogenic calli can be obtained within 4- 6 weeks of the initial explant and can be found directly on MS medium with kinetin (1.0 mg/lit.) + IAA (1.5 mg/lit.) and regeneration of multiple shoots can be obtained within 6-8 weeks on MS medium with BAP (2.0 mg/lit.) and rooting of these shoots could be obtained within four weeks on MS + NAA (3.0 mg/lit.) + sucrose (1.5%).

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ALLELOPATHIC IMPACT OF COLOCASIA ON CROP PLANTS

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ABSTRACT

The *in vivo* allelopathic effect of above ground portion of colocasia extract was assessed on germination, TDMP, VI and growth of rice, maize, ragi, cumbu, green gram, black gram, red gram, sesamum, sunflower, groundnut, sorghum and cotton at 10 and 30 DAS. The colocasia treatment drastically and significantly reduced, the germination, DMP and VI of rice, ragi, cumbu, black gram and goundnut. However, the other crops could resist the adverse allelopathic effect caused by colocasia, and higher DMP and VI recorded in the rest of the crops might be reflected in higher crop productivity. The adverse effect was possibly due to the leaching out of few allelochemicals which hamper the crop growth and performance.

Information on the allelopathic nature of many plant species have accumulated over the years as interactions between plants in an ecosystem become more thoroughly studied. Under field conditions the deleterious effect of an allelopathic plant agent upon another plant's growth and yield may be facilitated by exudates (Rice, 1974), leachates from decomposing residues and residues incorporated in the growing medium (Garcia and Anderson, 1984). Though the information on the allelopathic effects of many weed species is available, relatively less has been done on the allelopathic nature of some annual crops, in the tropics.

Patterson (1981) pointed out that allelopathic substances are released into the soil during decomposition of crop residues. In taro *Colocasia esculenta*, it has been observed by Rice (1974) in a field continuously planted to the crop succeeding

Table 1. Effect of aqueous extract of taro on germination, total dry matter production and vigour index of field crops

Crop	Germination %			TDMP (mg plant^{-1})						VI (10 DAS)		
	10 DAS			10 DAS			30 DAS					
	C	TET	Mean	C	TET	Mean	C	TET	Mean	C	TET	Mean
Rice	92.7	84.5	88.6	18.4	6.7	12.5	34.8	16.3	25.5	1721	571	1146
Maize	88.0	88.7	88.3	105.2	96.9	101.0	186.3	193.9	190.1	9323	8608	8966
Ragi	91.7	56.2	73.9	2.7	3.0	2.8	14.5	7.2	10.8	247	169	208
Cumbu	64.7	58.5	61.6	7.7	10.3	9.0	26.6	36.1	31.3	501	581	541
Green gram	96.7	80.5	88.6	20.9	22.1	21.5	79.3	51.4	65.3	2018	1342	1680
Black gram	75.5	92.7	84.1	38.4	28.7	33.5	90.6	86.8	88.7	2907	2686	2797
Red gram	56.2	80.7	68.4	28.8	19.1	23.9	115.3	104.8	110.0	1694	1537	1616
Sesamum	48.2	64.5	56.3	4.3	6.8	5.5	16.9	16.4	16.6	211	428	320
Sunflower	56.0	94.0	75.0	62.4	52.0	57.2	124.5	110.9	117.7	3225	4894	4210
Groundnut	57.0	66.7	61.8	124.8	215.8	170.3	301.2	241.3	271.2	7416	18001	12709
Sorghum	81.2	82.0	81.6	108.2	96.3	102.2	203.0	202.7	202.8	8787	7927	8357
Cotton	97.7	97.5	97.6	55.1	50.2	52.6	95.6	94.4	95.0	5382	4902	5142
Mean	75.4	78.8	-	48.0	50.6	-	107.3	96.8	-	3644	4303	-
		CD 5%		CD 5%		CD 5%		CD 5%				
Crops		8.83		13.5		17.47		2.26				
Treatment		NS		NS		7.13		0.92				
Interaction		12.54		19.10		24.70		3.20				

DAS : Days after sowing; C : Control, TET : Taro extract treated

taro crops normally do not exhibit good growth and development. Hence to understand the effect of taro extract on crops, the present experiment was carried out.

MATERIALS AND METHODS

A pot culture experiment was conducted in glass house to the study the allelopathic effect of *C.esculenta* on different field crops *viz.*, rice, maize, ragi, cumbu,green gram, black gram, red gram, sesamum, sunflower, groundnut, sorghum and cotton. The fresh vegetative portion of the taro was collected and its five per cent concentrated (W/V) solution soaked for a period of a 48h was used for the study. Five kg of orchard soil was filled in each pot and 250 ml of the above prepared extract was added pot $^{-1}$ before sowing the crop seeds. One hundred healthy seeds of each crop were sown in each pot and subsequently uniform quantity of tap water was used to maintain adequate moisture throughout the growth period. A control (without extract) was also maintained for comparison. The germination percentage by ISTA, lengths of root, shoot, total dry matter production (TDMP) by conventional methods and vigour index (VI) (Abdul-Baki and Anderson, 1973) were estimated. The data were analyed in a factorial randomised block design by the method of Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Germination percentage

The incorporation of aqueous extract of taro plant drastically reduced the germination of rice, ragi, cumbu and green gram and it may be due to the release of germination inhibitors such as organic acids, alkaloids as these crops could not resist the adverse effects caused by these chemicals (Evenari, 1949). (Table 1). In the case of maize, sorghum and cotton, there was no variation between the treatments compared to control. On the other hand, in black gram, red gram, sesamum, sunflower and groundnut, the germination was significantly higher than the control. The reduction noticed masinly in cereals and the beneficial effect observed in pulses and oilseeds indicated the species specificity of the allelochemicals released into the soil environment (Pardales and Dingal, 1988).

Vigour index

The poor VI (571) recorded for the taro treatment in rice was a result of lower germination

Table 2. Effect of aqueous extract of taro on root and shoot length (cm) of field crops

Crop	Root length						Shoot length					
	10 DAS			30 DAS			10 DAS			30 DAS		
	C	TET	Mean	C	TET	Mean	C	TET	Mean	C	TET	Mean
Rice	4.2	4.5	4.3	5.4	4.8	5.1	8.1	5.1	6.6	10.8	4.2	7.5
Maize	5.5	8.9	7.2	10.0	11.6	10.8	10.0	17.2	20.2	20.2	20.6	20.4
Ragi	3.3	1.4	2.3	4.5	5.0	4.7	5.7	3.4	4.5	6.6	9.8	8.2
Cumbu	4.2	3.0	3.6	4.2	8.0	6.1	16.5	11.2	13.8	14.9	46.1	30.5
Green gram	3.0	2.8	2.9	3.1	3.4	3.2	8.2	11.2	9.7	14.0	12.2	13.1
Black gram	3.2	2.3	2.7	3.7	3.2	3.4	15.0	5.2	10.1	20.1	12.6	16.3
Red gram	3.3	3.1	3.2	3.8	4.3	4.0	10.5	8.7	9.6	12.6	11.5	12.0
Sesamum	1.9	5.5	3.7	2.6	5.8	4.2	5.8	6.4	6.1	10.0	7.4	8.7
Sunflower	5.2	3.3	4.2	6.4	4.6	5.5	9.2	6.6	7.9	21.9	9.1	15.5
Groundnut	6.0	2.8	4.4	6.7	3.9	5.3	7.1	5.0	6.0	8.9	8.7	8.8
Sorghum	5.1	4.7	4.9	9.2	7.7	8.4	8.6	7.9	8.2	21.0	21.2	21.1
Cotton	3.6	3.8	3.7	7.7	6.4	7.0	12.9	11.1	12.0	20.3	21.4	20.8
Mean	4.0	3.8	-	5.6	5.7	-	9.8	8.2	-	15.1	15.4	-
	CD 5%			CD 5%			CD 5%			CD 5%		
Crops	0.34			0.65			1.21			1.52		
Treatment	0.26			0.38			1.06			1.71		
Interaction	1.25			1.43			2.04			5.48		

DAS : Days after sowing; C : Control, TET : Taro extract treated

percentage and poor biomass accumulation (Table 1). In the case of ragi, green gram and cumbu, eventhough the germination was reduced significantly, because of higher biomass accumulation, the vigour of seedlings could be increased. The increased biomass production by these crops could be possible due to the tolerance mechanisms possessed by them for the allelochemicals especially, the alkaloids contained in the water extract of taro leaf.

Dry matter production

The total dry matter accumulation is considered as one of the important factors which governs the crop productivity. In this regard, the taro crop drastically reduced total dry matter accumulation compared to control in rice (53.2%), ragi (50.4%), green gram (35.2%), red gram (9.2%) sunflower (11%) and groundnut (19.9%) respectively (Table 1). The reduction in biomass accumulation was possibly due to the phenolic acids and associated compounds such as scopoletin, chlorogenic acid and p-coumaric acid (Rice, 1974) in various field crops and the poor dry matter produced by the respective crops would lead to poor sink strength and ultimately result in poor grain yield. However, the crops which recorded higher dry matter for colocasia treatment might result in better productivity.

Length of root and shoot

Significant reduction in root length was observed in crops such as rice, black gram, groundnut and sorghum (Table 2).

The reduction in root growth might be due to the adverse effect of water soluble allelochemicals leached out from the taro extract (Guenzi and McCalla, 1962) in various crops. Almost similar trend of result has been observed in shoot length and the following crops *viz.*, black gram, sesamum, sunflower, groundnut and ragi recorded lower values compared to control and the difference was also significant. But cumbu which recorded poor root and shoot growth on 10th day recovered its growth on 30th day (46.1 cm).

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COMBINING ABILITY FOR YIELD AND YIELD COMPONENTS IN SORGHUM

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ABSTRACT

Combining ability for grain yield, panicle length, panicle weight and number of grains was estimated through a full diallel analysis involving 6 parents of sorghum *viz.*, Co.18, 148, Co.23, Co,22, CSV.3 and AS.3880 under four environments. The variances due to GCA and SCA were significant, the former being predominant. The operation of both additive and non-additive gene actions in the inheritance of the four characters studied was inferred. Among the parents P3 (Co.23) exhibited high positive and significant gca effects with high *per se* performance. The hybrid P4 X P5, P1 X P3 and P2 X P3 showed high positive significant sca effects for grain yield. The hybrids involving P3 as one of the parents were generally better in *per se* performance and sca effects for economic traits observed. Considering the gene actions (fixable and non-fixable) involved, a recurrent selection programme for the improvement of grain yield and its components is suggested.

A comprehensive understanding on the genetic architecture of the parents, knowledge on the combining ability of parents and hybrids, identification fo superior hybrid combinations for economic traits and recognising superior genotypes and hybrids favourably interacting with environments are the essential needs of a breeder for implementing a systematic crop improvement programme. The present investigation was oriented towards eliciting basic and applied information on the above aspects and to formulate a breeding strategy to be adopted in sorghum *(Sorghum bicolor* L. Moench) with special reference to the set of materials involved, through a diallel analysis.

MATERIALS AND METHODS

Six promising genotypes of sorghum *viz.* Co.18, 148, Co.23, Co.22, CSV.3 and AS.3880, chosen for diversity in panicle shape and compactness were crossed in all the possible combinations including reciprocals at the Sorghum unit, Tamil Nadu Agricultural University, Coimbatore, during monsoon 1980, by adopting hand emasculation and artificial pollination. The resultant 36 progenies (30 hybrids + 6 parents) were raised in a randomised block design replicated thrice in two seasons *viz* summer, 1981 (January - April) and monsoon, 1981 (July -October) under two levels of fertility conditions (High: 100 N + 80 P_2O_5 + 60 K_2Okg/ha and Low : No fertilizers).

The four environmental conditions provided for the study were

E1 : 1981 summer season : High fertility
E2 : 1981 summer season : Low fertility
E3 : 1981 monsoon season : High fertility
E4 : 1981 monsoon season : Low fertility

Each genotype was raised in three rows of 3 m length in each replication. A spacing of 45 cm between rows and 15 cm between plants in the row was adopted. Observations on panicle length, panicle weight, number of grains/panicle and grain yield/plant were recorded in ten plants selected at random. Combining ability analysis out lined by Griffing (1956) for individual environment and pooled analysis over environment following Daljit Singh (1979) for method I - Model I were adopted.