DIFFERENTIAL TOLERANCE OF TOO RICE (Oryza sativa L.) CULTIVARS TO DIMETHAMETRYNE

BY

ADEKPE, DAVID IDOKO

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DEPARTMENT OF AGRONOMY
FACULTY OF AGRICULTURE
AHMADU BELLO UNIVERSITY
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DECLARATION

I hereby declare that this thesis entitled "Differential tolerance of rice (*Oryza sativa* L.) cultivars to dimethametryne" has been written by me and that it is a record of my own research work. It has not been presented before in any previous application for a higher degree.

D.I. ADEKPE

(Candidate)

Date: 28/01/99

The above declaration is confirmed.

Dr. W.B. NDAHI

(Chairman, Supervisory Committee)

Date: 22-2-99

CERTIFICATION

This thesis entitled "Differential tolerance of rice (*Oryza sativa* L.) cultivars to dimethametryne by ADEKPE, Idoko David meets the regulations governing the award of the degree of Master of Science in Agronomy of Ahmadu Bello University, Zaria and is approved for its contribution to scientific knowledge and literary presentation.

Dr. W.B. NDAHI
Chairman, Supervisory Comm.
Date: 22-2-99

Prof. S.T.O. Lagoke
Member Supervisory Comm.
Date: 22/2/99

Dr. S.A. DADARI
Member, Supervisory Committee
Date: 22-02-99

Dr. E.B. Amans
Head, Agronomy Department
Date: 23/2/99

Prof. J.Y. Olayemi
Dean, Postgraduate School

DEDICATION

This work is dedicated to my dear wife, Mrs. Adekpe Anthonia, U. and my son, Goodnews for their patience, sacrifice and love to me during the course of my study.

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ABSTRACT

Both the screen house and field trials were conducted at Samaru Zaria (11°11'N 7° 35'E) in the Northern Guinea savanna of Nigeria, to study the tolerance of two selected rice *(Oryza sativa* L.) cultivars (ITA 257 and Ex-China) to various rates of dimethametryne (herbicide). Dimethametryne (herbicide) was evaluated at 0.25, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 and 4.0kg ai/ha.

The result obtained indcated that dimethametryne at low to near medium rates (0.25 - 1.5kg ai/ha) were well tolerated while medium to high rates (2.0 - 4.0kg ai/ha) were observed to be phytotoxic to rice cultivars in both trials. Dimethametryne at 3.0 - 4.0kg ai/ha resulted in total crop loss before 4WAS in the screen house trial.

Rice cultivars responded differentially to the various rates of dimethametryne particularly at medium to high rates (2.0 - 4.0kg ai/ha) in the field. ITA 257 was found to be more tolerant to the herbicide rates than Ex-China in both trials resulting in its (ITA 257) least injury, better growth vigour, higher LA/plant, shoot dry weight and paddy yield.

Shoot dry weight at 12WAS in the screen house and paddy yield in the field correlated negatively with herbicide injury while these (shoot dry weight at 12WAS and paddy yield) were positively correlated with crop vigour, LA/plant, plant height and tiller number/plant in both trials. No correlation was observed between shoot dry weight, paddy yield and crop emergence in both trials.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 RICE PRODUCTION AND USES

Rice (*Oryza sativa* L) belongs to the grass family gramineae of the genus *Oryza* (L). Rice which is the only cultivated cereal crop adapted to both flooded and non-flooded soils, is the third most important food crop after wheat and maize in the world. The distribution of rice throughout the continents of the world is uneven. About 89% of the world rice crop come from Asia, 8% from America, 2.6% from Africa and 0.4% from Europe (Warren and Martin, 1967; Konokhova, 1985). About one-quarter of the world's rice is grown under upland conditions (Jacquot and Courtois, 1987). The earliest cultivation of rice in Nigeria dated back as 1890 when upland varieties were introduced into the rain forest zone of western Nigeria (Grist, 1965). The estimated world paddy rice production between 1993/94 season stood at 520.2 million tones out of which Africa contributed 14.8 million tons. Of the 6.6 million tons produced in West - Africa, 3.4MT was produced in Nigeria (FAO, 1994).

The crop supplies the major food requirements for more than half of the world's population (Grist, 1975). Rice grain is either boiled and eaten whole with spiced stew, soup and vegetables or prepared into various types of liquid and solid porridges. The oil from the bran is used for cooking meals, soap making, as carrier for insecticides and also as an anti-corrosives. The hull, aleurone layer and germ are used in the production of phytin and Vit. B (Thiamine, Riboflavin and Niacin). Rice grain is known to

contain about 75.5% Carbohydrates, 8.6% protein, 0.8% fat and 13.3% water (Anon; 1986). In countries like China, Japan and Korea, starch, alcoholic beverages and soft drinks are manufactured from rice. Rice straw and husk are source of fuel, used in the manufacture of strawboards, for thatching and making of hats and mats.

1.2 PROBLEMS ASSOCIATED WITH RICE PRODUCTION

Various factors including weeds contribute to low yields in rice. Yield losses caused by uncontrolled weed growth in rice has been observed to range between 10-100% in both low land and upland ecologies of tropical Africa (Swain *et al*, 1975; Akobundu, 1987; Oloruntoba, 1992). Total crop failure may result in upland rice if weeds are not controlled (Lavabre, 1991). Weeds compete with rice for light, nutrients and moisture. They also adversely affect the micro climate around the plant and harbour disease vectors and pests thereby reducing yield, lower the market value. Notable weeds of rice include barnyard grass (*Echinochloa* spp stev), Rice cutgrass (*Leersia oryzoides* L.), common reed (*Phragmites communis* Trin), Bulrush (*Roldoschoenus compastus* hoffm); *Rottboelia cochinchinensis* among others (Gordon, 1967; Konokhova, 1985). Akobundu (1987) reported that specific weeds which cause major losses in rice vary from one ecology to another and that weed pressure in a given ecology is influenced by soil fertility level, rice cultivars, frequency of land use, water management, seeding method and weed control method.

The most critical periods of yield losses due to weed infestation range between 10 - 20 days after emergence (DAE) for direct seeded and 4 - 6 weeks for transplanted rice (Ndahi, 1981; Zimdahl, 1980; Oloruntoba, 1992). Weeds interfere with yields in rice by affecting yield components such as tillering, panicle number and number of grains per panicle.

1.3 EXISTING METHODS OF WEEDS CONTROL

To avert the yield losses due to weeds, several control measures have been adopted. These include, hand pulling, use of sharpsticks, hoe-weeding, animal and mechanical power and chemical weed control. The judicious use of herbicides (Chemical method) will not only reduce labour requirements and its cost, but will also facilitate timely weeding. If applied appropriately, herbicides will effectively control weeds in rice thereby giving higher yields.

The use of herbicides has gained wide acceptance as a means for weed control since the discovery of 2,4-D and propanil in 1942. Results of several trials from rice growing areas of the world including Nigeria showed that herbicides used alone or in combination are effective in controlling weeds in rice (Moowaw et al., 1966; Moody, 1977; Noda, 1977, Moody, 1980; Akobundu, 1987).

Since rice cultivars have been observed to respond differentially to herbicides (Oosterhius et al., 1990; Shin et al., 1992; Mabbayad et al., 1992; Pantone and Baker, 1992; Zhang and Tang, 1991) a blanket recommendation on the use of herbicide for weed control in the crop cultivars may not be advisable.

1.4 THE USE OF DIMETHAMETRYNE IN CROPS

Dimethemetryne alone or in mixture with other herbicides which are found to be effective against both broadleaf weeds and young grasses are known to be tolerated by crops such Maize, Sorghum, Rice, Sugar cane and Cotton (Anon, 1985; Anon, 1988; Yayock, 1988 and Fadayomi, 1996). Dimethametryne is rapidly degraded in soils with low clay, organic matter content therefore pose little problem of environmental hazard.

Chinawang et al (1988) in evaluating the differential phytotoxicity of simetryn and dimethametryne to rice cultivars observed that dimethametryne was more phytotoxic to the crop mainly due to its slower rate of metabolism. Fukushima and Manabe (1992) reported crop damage exhibited by reduced plant height, stand, size and leaf blade, length of nodes when a combination of pretilachlor, dimethametryne and CG - 113D was applied at 3kg ai/ha 5 days after transplanting. But Dextrazer and Belanger (1990) found no residual effect in vice field soil treated with 4l/ha of rifit extra (Pretilachlor and dimethametryne) or between untreated grains and those from plants treated with 1.6l/ha. Due to the possible existence of intraspecific variation in regards to tolerance of crop cultivars to any given herbicide, the objective of this study was therefore, to evaluate the tolerance of two selected rice cultivar to various rates of dimethametryne.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1.0 Tolerance of Plants/Crops to Herbicides

The tolerance of a plant to herbicides is dependent on the plant's genetic constituent and age, morphology, physiology and biochemistry, type of herbicide, its formulation and dosage and environmental factors among others which affect uptake, translocation and metabolism of the herbicide (Akobundu 1987; Moody and Madrib, 1984).

2.1.1 Genetic constituent of the Plant and Age

The genetic make-up of a plant to some extent determines the response of the plant to its habitat. The variation may exist from genus to genus, between species of the same genus (Klingman & Floyd 1975). Plant age can influence the extent to which it responds to herbicides. For example, young plants and seedlings are more susceptible to herbicides than older plants especially to contact herbicides (Anderson, 1977).

2.1.2 Plant Morphology

Morphological difference exist among plants especially in leaves, growing points and root. These can determine whether or not a plant can be killed by herbicides.

2.1.3 Plant Physiology and Biochemistry

Absorptive degree of a plant is a characteristics of its physiology. It is generally noted that plants that absorb and translocate greatest amount of herbicides fast are likely to be killed faster.

2.1.4 Types of Herbicides, Formulation and Dose

All herbicides do not trigger off same symptoms or signs on the target plants. For this reason, they are classified based on their time of application, where they are applied, their translocation in plants, types of plant affected. To enhance the efficiency of a given herbicide, it may be necessary to add other substances like adjuvants and surfactants in its formulation. It is generally noted that herbicides are more selective at low to moderate doses than at higher dosage (Akobundu, 1981; Anderson, 1977).

2.1.5 Environmental Factors

Factors of the environment that enhance plants susceptibility to the applied herbicide include light intensity, water and temperature. It is noted that plants grown in poor light intensity areas are more susceptible to herbicides applied foliarly than those growing under bright light intensity due to the presence of thinner and more permeable cuticle in the former. In the same way, water stressed plants withstand foliar applied herbicides than plants of less exposed and permeable cuticle. Plants are known to be less affected by herbicide at temperatures above or below those favouring growth (Anderson, 1977).

2.2 DIFFERENTIAL TOLERANCE OF CROP CULTIVARS TO HERBICIDES

Variability exists in crop plants brought about by the process of mutation, hybridization, artificial selection leading to adaptation to a wide range of conditions. The variability provides an important safety factor because if one cultivar was to be unusually susceptible to a particular herbicide, others may be resistant (Raven et al., 1976). Akobundu (1987) reported that differences exist in the level of tolerance among cultivars of the same species, species of the same genus and among plants from different genera. To this effect, herbicides selectivity is based on the understanding of the differences in the level of tolerance/response that crop cultivars have to varying herbicides.

Shebayan (1982) in a study to evaluate the response of sorghum varieties to herbicides reported that sorghum varieties responded differentially to the herbicides tested at both Mokwa and Samaru. Keifer (1989) reported a relative tolerance to soil incorporated clomazone by hybrid and inbred maize (*Zea mays* L) as assessed by the level of discoloration and injury in the green house. Lanari (1986) showed that grain yields of three corn cultivars out of the 42 cultivars tested were significantly reduced by 0.47kg ai/ha bromoxynil and the yield of one cultivar reduced by 0.23kg ai/ha dicamba, both herbicides were applied Post-emergence. Cochet et al., (1979) observed differential response of hard and soft spring wheat cultivars to pre-emergence application of 11.25g/ha. Isoproturon and 2250g/ha of neburon respectively.

Walters and Cavines (1988) and Weese et al., (1989) observed a differential susceptibility of some soyabean cultivars to 2,4 - D and Metribuzin in both the screen house and field trials respectively. In evaluating the phytotoxicity of metribuzin in five tomato cultivars sown directly or transplanted, Garcia and Mata (1985) observed leaves discoloration and reduced height among cultivars transplanted. A considerable variation was observed in fibre quality of five upland cultivars of cotton treated with herbicides. Ulano (1980) showed that an application of prometryn, cotoran and trifluralin to cotton increased the plant density of some cultivars and decreased others. In studying the tolerance of 22 potato cultivars to metribuzin, George et al., (1984) observed reduction in crop stand, leaf burning, and delayed vine maturity among cultivars tested.

2.3 SOME EFFECTS OF HERBICIDES ON RICE

In a field study carried out to evaluate the residual effect of three dinitroanilline herbicides on rice growth, Fayte et al., (1982) reported that all these herbicides considerably reduced paddy yield at application rates above 0.1kg ai/ha. Wills and Street (1989) reported rice leaf burn by both propanil and butachlor + methyl parathion applied at 3-4 leaf stage. The injury was induced by high temperature, low relative humidity and soil moisture. Similarly, Richard et al., (1980) observed a temporary rice injury in form of stunting to leaf burning treated with bifenox applied Post-emergence at 316/acre. Bargan (1992) found a

decrease in tiller number, height at harvest and paddy yield of rice by applying fenoxaprop-ethyl at 120g to five rice cultivars 42 days after transplanting (DAT). Similarly, Snipes et al., (1984) reported significant reduction in rice paddy yield due to the application of Fenoxaprop-ethyl at 0.1 and 0.17kg ai/ha at booting and heading under sprinkler irrigation and flood culture respectively. Singh et al (1985) also observed a significant decrease in plant height and delayed maturity by 7 days when fluazifop-butyl was applied at rate above 24kg ai/ha to rice crop. several other workers reported significant reduction in rice plant height, shoot dry weight, decreased plant density and height, epicotyl growth inhibition, paddy yield reduction in rice crop treated with different herbicides and herbicide mixtures (Gill et al., 1985; Smith, 1988; Zhang, 1987; Pablico and Moody, 1991) applied at different growth stages.

In field evaluation of pendimethalin, butachlor, thiobencarb and 2,4-D, it was observed that these herbicides and their sequence applied after sowing and/or transplanting affected the chlorophyll and minerals (K, Ca, Fe) content of the leaves of rice (Singh et al., 1985). Herbicides do not only negatively affect rice crop yield and yields components, they also have positive effects by way of increasing yield of rice and reduction in weeds interference. In the irrigated lowland of Badeggi, in the Southern Guinea of Nigeria, Flourodifen at 4.0kg ai/ha. propanil at 6.7 kg ai/ha resulted in increased paddy yield that was comparable to 2 hand-weeding and significantly higher than that of untreated control

(Anon, 1970). Also, propanil, at 5.0kg ai/ha resulted in comparable paddy yield to 2 hand-weeding (Anon, 1973). In direct seeded irrigated rice at Ngala in the Chad Basin of Nigeria Okafor, (1986) found that thiobencarb at 5.0kg ai/ha, propanil + bromoxynil at 3.6 + 0.4 kg ai/ha; Propanil + oxadiazone at 3.0 + 1.0 kg ai/ha resulted in comparable paddy yield to hand-weeding. High and significant increase in paddy yield rice was observed with 2 splits application of propanil (4.0 + 3.0 and 3.4 + 3.4kg ai/ha respectively) and propanil + butachlor (3.0 + 2.0 kg ai/ha) (Richard and street, 1984; Bhagwan et al., 1986).

2.4 TOLERANCE/RESPONSE OF RICE CULTIVARS TO HERBICIDES

Tolerance of rice cultivars to herbicides depended on morphology, physiology and biochemistry among others which affected uptake, translocation and metabolism of the herbicides (Moody and Madrib, 1984; Achhireddy et al., 1985). Herbicides that are commonly used for weed control in rice consist of broadleaf killers, grass killers and broad spectrum types. The herbicides can be used singly or in mixture form for effective weed control and can be applied pre or post-emergence to either the weed or crop or both.

In a pot experiment using 2 rice cultivars C-168 and 1R36, Noriel and Mercado (1981) observed that butachlor solution at 30ml of 50ppm applied to meocotyl and coleoptile caused more growth inhibition in cultivar 1R36 than in C-168 at field capacity and saturation levels, the herbicide was toxic to cultivar C - 168 at

field capacity. In mannila philippines, Shin et al., (1992) reported differential tolerance in 300 rice cultivars to $5x10^{-6}$ - $2x10^{-5}$ moles ai/ha butachlor, thiobencarb and simetryn in both laboratory and field experiments. Pantone and Baker (1992) observed differential responses in three rice cultivars (Lemont, Mars and Tebonnet) to 2 rates of bromoxynil at 0.3 and 0.6kg ai/ha, trichopyr at 0.4 and 0.8 kg ai/ha applied at different growth stages. Varietal susceptibility as exhibited by inhibited shoot growth was observed in 12 rice cultivars sprayed with 2.4 - D and exposed to ethylene (Colon and Amarale, 1985). Zhang and Tang (1991) reported varietal sensitivity of rice to butachlor applied at 20-500g/ha during germination. Carrol and Crawfor (1984); Oosterhuis et al., (1990) observed leaf chlorosis and stunting in rice cultivars treated with HOE-33171 at 316/acre applied at 3-7 leaf stage while Snipes and Street (1987) showed that Fenoxaprop markedly affected the paddy yield, milking and seed quality of rice cultivars (New bonnet and starbonnet) under flooded condition. A phytotoxicity effect of Fenoxaprop on rice cultivars applied at 1.71/ha Post-emergence was reported by Ramose and Alves, 1988; Griffin and Baker, 1990 respectively).

2.5 CHARACTERISTICS OF DIMETHAMETRYNE

Dimethametryne (4-(1,2 - dimethyl-n-propyl-amino)-2-ethyl amino-6-methylthio-5-triazine), a symmetrical methythio triazine is solid at room temperature with a water solubility of 50mg/l. It is highly soluble in common organic solvents and has a melting point

of 65^{0c}, boiling point of 151 - 153^{0c} at 0.5mmHg. It has an LD_{50} (rat) of about 300mg/kg body weight. The site of action is the inhibition of the Hill reaction of photosynthesis in susceptible plants (Audus, 1964, Good, 1961). Dimethametryne selectivity in rice is said to be based on physiology. Rice plants are capable of converting dimethametryne into harmless metabolites which form some conjugates with the plant (rice) constituents.

Dimethametryne alone or and in mixture with other herbicides is known to be effective in the control of broadleaved and grassy weeds and tolerated by some crops. It's also known to control emerging *Striga* when used alone or in combination with 2.4 -D or diflufenica (Anon, 1988). The mixture of dimethametryne and Cotoran multi at 1.0 + 1.0 was observed to reduce weeds infestation effectively and produced high seed cotton yields (Anon, 1985). Similarly, the post emergence application of dimethametryne after pre-emergence application of prometryne and Gardoprim A was observed to effectively reduce the dry weight of weeds in a millet/cowpea relay cropping (Anon, 1988). Martin and Worthing (1974) showed that dimethametryne was effective against broadleaved weeds in rice. At Ibadan in the forest ecology of Nigeria, significant weed control with high paddy yield was obtained when dimethametryne + piperophes + propanil was applied at 0.2 + 0.8 + 1.8 kg ai/ha (Anon, 1986). Enyinna (1992) reported a good weed control and rice tolerance using Rifit extra (Pretilachlor F dimethametryne) at 2.5kg ai/ha. Fadayomi (1996) reported a satisfactory control of itchgrass (*R. Cochinchinensis* (Lour)

clayton) with post-emergence application of dimethametryne at 4-6kg ai/ha. He further indicated that the weed control effectiveness of the herbicide was enhanced when used in combination with diuron at 2.0kg ai/ha while crop selectivity was better when dimethametryne was applied as a post-emergence supplement to pre-emergence application of diuron. While Yayock (1988) observed that dimethametryn at 0.5 to 1.5 kg ai/ha applied 4 WAS as directed and overall effectively controlled broadleave weeds and sedges but significantly depressed yield of maize, growth of millet and sorghum. Imeokparia (1990) observed significant paddy production and weed control at Bende, Nigeria using Avorisan (piperephos + dimethametryne) at 1.6 to 4.0 kg ai/ha applied post-emergence.

CHAPTER 3

3.0 MATERIALS AND METHODS

3.1.0 Experimental Site

Field trial was conducted to evaluate the effect of rates of dimethametryne on rice cultivars during the 1995 cropping season at the Research Farm of the Institute for Agricultural Research (IAR), Samaru - Zaria ($11^{0}10^{0N}75^{0}35$ 680 meters above sea level) in the Northern Guinea Savannah ecological zone of Nigeria. A similar experiment was also carried out in the screen in 1995. The soil of the site of field trial was silt loam while that of the screen house was clay loam. A total of 850.5mm rainfall was recorded during the period of crop growth in 1995. Details of the physico-chemical composition of the soils of both trials, rainfall distribution, Relative humidity and temperature at Samaru during the period are shown in Tables 1 and 2 respectively. The common weed species found at the experimental site and the screen house are shown in Table 3.

3.2 EXPERIMENTAL DESIGN, TREATMENT AND PLOT SIZE

The field experiment was laid out in a split plot design with herbicide rates as the main plot treatment and two rice cultivars, (ITA257 and Ex-China) the sub plot treatment. The main plot treatment consisted of dimethametryne applied pre-emergence at rates 0.25, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 and 4.0kg ai/ha compared with no-herbicide control while the sub-plot

Table 1: SELECTED PHYSICO-CHEMICAL PROPERTIES OF THE EXPERIMENTAL SOILS AT SAMARU IN 1995

CHARATERISTICS	SOIL PROPERTIES DEPT (0-30CM)	
Physical Properties	Screen House	Field
Sand (%)	25	35
Silt(%)	30	35
Clay(%)	45	30
Textural Class	Clay Loam	Loamy
Chemical Properties		
P^H in H_2O	6.0	6.5
Organic Carbon (%)	0.68	0.84
Available Phosphorus(Bray 1)PPM	15.06	17.02
Total Nitrogen (%)	0.03	0.05
Exchangeable Cations (Meg/100g Soil)		
Soduim (Na^+)	0.04	0.03
Potassium(K^+)	0.06	0.04
Calcuim(Ca^{2+})	0.72	0.65
Magnesium(Mg^{2+})	0.05	0.02
$H^+ + Al^{3+}$	0.80	0.72
CEC	2.14	2.06
Base Saturation(%)	64.0	60.0

Table 2: Rainfall, Temperature And Relative Humidity at Ten Days Intervals During the Period of the Experiment, 1995.

MONTH	DAYS	RAINFALL	TEMPERATURE (°C) MIN	MAX	RELATIVE HUMIDITY 10AM	4PM
	1-10	-	17.1	36.2	23.1	31.9
MARCH	11-20	-	17.1	36.1	30.8	33.7
	21-31	-	22.7	38.6	26.4	26.9
	1-10	-	21.0	41.3	33.5	28.7
APRIL	11-20	14.0	20.5	36.7	29.1	26.8
	21-30	76.5	16.6	30.7	60.9	37.6
	1-10	30.8	16.8	32.5	75.0	52.8
MAY	11-20	-	14.4	37.4	57.4	30.8
	21-31	14.5	18.1	39.3	71.6	38.8
	1-10	39.4	33.1	36.0	11.2	66.0
JUNE	11-20	58.7	14.0	32.4	69.7	41.9
	21-30	19.6	18.8	29.9	78.6	58.6
	1-10	36.8	21.8	28.9	79.6	59.6
JULY	11-20	52.1	22.7	30.2	79.4	66.9
	21-31	67.8	22.9	33.3	90.4	73.4
	1-10	88.4	17.9	28.8	84.5	74.4
AUGUST	11-20	73.6	19.5	29.1	82.8	73.1
	21-31	96.7	22.9	31.3	86.4	88.7
	1-10	39.3	21.9	29.5	81.9	78.1
SEPTEMBER	11-20	80.5	18.9	29.4	73.3	68.7
	21-30	39.3	20.5	27.9	80.5	62.7
	1-10	32.5	20.1	32.6	77.8	68.7
OCTOBER	11-20	-	18.7	32.6	71.2	44.5
	21-31	-	18.3	35.4	80.6	58.0
Total		850.5				

Source: Meterological Station - IAR, Samaru Zaria.

Table 3: LIST OF COMMON WEED SPECIES AT EXPERIMENTAL SITES, IN SAMARU

TYPES OF WEEDS	LEVEL OF INFESTATION SCREEN HOUSE	FIELD
SEDGES		
Cyperus esculentus Linn	*[1]	***[3]
Cyperus rotundus Linn	*	***
GRASS WEEDS		
Cynodon dactylon (Linn) Pers	*	***
Eleusine indica Gaertn	*	***
Eragrostis tremula Hochst(L) P.Beaur	*	***
Chloris Pilosa Schumach	*	***
BROADLEAVED WEEDS		
Commelina benghalensis (L)	**[2]	*
Portulacia Oleracea (L)	**	*
Ipomoea vagans pak	*	**
Vernonia ambigua kotschy and Peyr	*	**

1 - Low infestation

2 - Moderate infestation

3 - High inestation.

treatment was two cultivars of rice. All the treatments were replicated three times. The gross and net plot sizes were 14.0m^2 and 7.5m^2 respectively. The herbicide was applied pre-emergence one day after sowing (DAS) using the CP3 Knapsack sprayer with a deflector nozzle covering a swath of 75cm with a pressure of 2.1kg/m^2 and discharge rate of 2001/ha.

3.3.0 CULTURAL PRACTICES

3.3.1 Field Experiment

The land was ploughed, harrowed (after seven days) to a fine tilth and made into beds with raised edges before the trial was established on the 3rd July, 1995. The two rice cultivars tested were drill-seeded at an inter-row spacing of 30cm. Fertilizers at the rate of 30kg P_2O_5/ha and 30kg K_2O/ha were applied by side dressing at two weeks after sowing (WAS) using single super phosphate (ssp) and muriate of potash respectively. Nitrogen at the rate of 50Kg N/ha was split applied at 2 and 7WAS by side dressing using urea. The trial was kept weed-free throughout the experimental period to prevent weed interference by careful hoe-weeding at 3,6 and 9WAS.

3.3.2 Screen House Experiment

The trial which was established on the 31st March and terminated 23rd June, 1995 was conducted in the screen house of Institute for Agricultural Research (IAR), Samaru - Zaria.

The 15 litre plastic pots were filled with soil up to two-third (2/3) volume of each. The rice cultivars were planted by broadcast, covered with soil in the pots before watering each plastic pot to field capacity. The pots were arranged in a completely randomized design in three repititions. The herbicide treatment, rates and application method were the same as in the field trial. During herbicide application, all the pots with the same treatment number were arranged in a marked out area in a straight line and sprayed. After each treatment application, the pots were returned to the screen house. Seeds of rice cultivars used were obtained from National Seed Service depot, Zaria.

3.4.0 Agronomic Characters of The Rice Cultivars

3.4.1 ITA 257

This cultivar was developed at IITA, Ibadan for upland culture and it is recommended for drier Northern Parts of Nigeria. It is a tall cultivar (100cm and above) with low tillering capacity. This is an early maturing rice cultivar (95 - 100 days) with long grain.

3.4.2 Ex - China

This cultivar is said to be developed by International Rice Research Institute (IRRI) philippines. It is adapted to both upland and shallow swamp cultures. It is a crop of medium height (90 - 100cm) with moderate tillering capacity

and maturing in about 100 - 110 days. The panicle is about 5 - 10cm in length but with short peduncle. The grain is short, bold and rough to feel.

3.5.0 Observation and Data Collection

Data collected on parameters in both the field and screen house trials included:-

3.5.1 Crop Emergence Score

This was taken ten days after sowing (DAS) to determine the effect of the herbicide rates on seedling emergence using a zero to nine (0-9) scale where nine represents complete emergence and zero, no emergence.

3.5.2 Crop Injury Score

Crop injury was assessed through visual observation at 2,3 and 4 weeks after sowing (WAS) using a zero to nine (0-9) scale where nine represents total kill and zero, no injury.

3.5.3 Crop Vigour Score

Crop vigour was also visually rated at 2,4,6,8 and 10 weeks after sowing (WAS) using a zero to nine scale where nine stands for most vigorous while zero represents least vigorous.

3.5.4 Plant Height (Cm)

Average heights of ten randomly selected rice plants in each net plot and pot was taken at 3,6,9 and 12 WAS.

3.5.5. Shoot Dry Weight (g/Ten Plants)

Weight of ten randomly sampled rice plants from each net plot and pot was taken after oven dried for 48 hours at 70^0c at 4,8 and 12 WAS.

3.5.6 Leaf Area/Plant (cm^2)

Average leaf area/plant was taken at 4, 8 and 12 WAS from ten randomly sampled rice plants in each net plot and pot. Measurements were taken from leaves of all the tillers in each case by measuring length and breadth of each leaf and multiplied by a constant 0.72 (Waston, 1974) and divided by the number of plants sampled.

3.5.7 Number of Tillers/Plant

Tiller number of rice cultivars was taken from ten tagged plants per net plot and pot at 6,8,10 and 12 WAS.

3.5.8 Paddy Yield at Harvest (kg/ha)

Paddy yield at harvest of each rice cultivar from each net plot was obtained by weighing after threshing.

3.6.0 Data Analysis

All the data were subjected to analysis of variance (ANOVA) and the treatment means were compared using DUNCAN MULTIPLE RANGE TEST (DMRT), where F - Value was significant (DUNCAN, 1955).

CHAPTER FOUR

4.0 RESULTS

4.1 CROP EMERGENCE SCORE

The effect of dimethametryne on the emergence of seedlings of rice cultivars at ten days after sowing (DAS) in both the screen house and field studies was not significant. However, rice cultiver Ex-china had higher emergence score compared with ITA 257(Table 4). The interaction of dimethametryne rates and rice cultivars on seedlings emergence was not significant in both the screen house and field studies (Table 4).

Table 4: EFFECT OF DIMETHAMETRYNE ON THE EMERGENCE OF RICE CULTIVARS IN THE SCREEN HOUSE AND FIELD AT 10DAS AT SAMARU - ZARIA, 1995.

Experimental Treatment Dimethametryne (D)	Crop emergence at 10 days after sowing (DAS)	
(kg ai/ha)	Screen house	Field
0.00(Control)	8.00	8.70
0.25[4]	8.50[1]	8.20
0.50	7.67	8.00
1.00	8.00	8.00
1.50	8.00	8.20
2.00	8.00	8.20
2.50	7.50	7.83
3.00	8.00	7.83
3.50	8.00	8.00
4.00	8.00	7.83
SE(±)	0.316NS[3]	0.50NS
Cultivars (C)		
ITA 257	7.07b	7.53b
Ex-China	8.87a	8.60a
SE(±)	0.141	0.172
Interaction		
D x C (SE±)	NS	NS
Significance		

1 - Means followed by the same letter(s) within a treatment group are NOT significant statistically using DMRT.
2 - Dimethametryne rates
3 - Not significant

4.2 CROP INJURY SCORE

Dimethametryne had significant effect on the injury of rice cultivars at 2,3 and 4 WAS in both the screen house and field studies (Tables 5 and 6). Dimethametryne at 0.25 Kgai/ha in the screen house and 0.25 to 1.0kgai/ha in the field at 2,3 and 4 WAS as well as 0.5Kgai/ha at 2 WAS in the screen house did not cause any significant injury compared with the no-herbicide

control. Injury scores significantly increased with dimethametryne at .5 to 3.0 kgai/ha at 2 WAS, .25 to 3.0 kgai/ha at 3 and 4 WAS in the screen house. However, dimethametryne at 2.50 kgai/ha resulted in significantly lower injury score than the higher rate of the herbicide but significantly higher injury scores than the lower rates at 2,3 and 4 WAS. Similar maximum injury scores occurred at all cases at 3.0 to 4.0 kgai/ha in the screen house. In actual fact these rates resulted in complete crop loss as from 3 was in the screen house.

In the field at 2 WAS, dimethametryne at 4.0kgai/ha resulted in significantly higher injury score than the lower rates. Also at 2 WAS , the injury score observed with dimethametryne at 1.5 and 2.0kgai/ha were similar but significantly lower than those of the higher rates of dimethametryne. Similarly, while dimethametryne at 2.5 and 3.5 kgai/ha caused similar injury scores only 2.5kgai/ha resulted in lower score than 3.50 kgai/ha. On the other hand, the injury score observed with dimethametryne at 2.0 kgai/ha was significantly higher than with rate 1.5kgai/ha and below at 3 and 4 WAS (Table 6).

The rice cultivars differed significantly in injury score where Ex-china exhibited higher injury scores compared with ITA 257 at all the sampling dates in both the screen house and field studies(Tables 5 and 6).

Table 5: EFFECT OF DIMETHAMETRYNE ON RICE CULTIVAR INJURY IN THE SCREEN HOUSE AT SAMARU-ZARIA, 1995

Experimental Treatment Dimethnmetryne Rates (D) (Kgai/ha)	Crop INJURY SCORES[1] 2 WAS[2]	3 WAS	4 WAS
0.00(Control)	0.00f	0.00g	0.00g
0.25[3]	0.00f[4]	0.00g	0.00g
0.50	0.17f	0.70f	0.70f
1.00	1.17e	2.70e	2.70e
1.50	2.33d	5.00d	5.00d
2.00	3.33c	6.50c	6.83c
2.50	5.83b	7.67b	7.67b
3.00	8.00a	8.67a	9.00a
3.50	8.00a	9.00a	9.00a
4.00	8.00a	9.00a	9.00a
SE(±)	0.118	0.140	0.140
CULTIVARS(C)			
ITA 257	3.50b	4.67b	4.80b
EX-CHINA	3.90a	5.17a	5.17a
SE(±)	0.053	0.063	0.063
INTERACTION			
D. X C (SE±	50.1667	0.1972	0.1972
SIGN.	*[5]	NS[6]	NS

1 - Based on 0 - 9 Scale
2 - Weeks after Sowing
3 - Rates of dimethametryne
4 - Means followed by the same letter(s) within a treatment group is not not significant different at 5% level of significance using DMRT.
5 - Significant at 5% level.
6 - Not Significant.

Table 6: Effect of dimethametryne on rice cultivars injury in the field at Samaru - Zaria, 1995.

Experimental Treatment Dimethametryne Rates (D)	Crop injury Score[1]		
(kg ai/ha)	2WAS[2]	3WAS	4WAS
0.00(Control)	0.00e	0.00d	0.00d
0.25[4]	0.00e[3]	0.00d	0.00d
0.50	0.00e	0.00d	0.00d
1.00	0.33e	0.00d	0.00d
1.50	2.33d	2.33c	2.33c
2.00	2.33d	5.83b	5.83b
2.50	3.17c	6.16ab	6.16ab
3.00	3.67bc	6.83ab	6.83ab
3.50	4.17b	7.50a	7.50a
4.00	5.17a	6.67ab	6.67ab
SE(±)	0.146	0.446	0.465
Cultivars			
ITA 257	1.97b	3.30b	3.33b
Ex-China	2.27a	3.77a	3.77a
SE(±)	0.058	0.041	0.041
Interaction D x C	*[5]	NS[6]	NS

1 - Based on 0 - 9 Scale
2 - Weeks after sowing
3 - Means followed by the same letter(s) within a treatment group for a particular character is/are significant statistically using DMRT
4 - Rates of dimethametryne
5 - Significant at 5% level
6 - Not Significant

The interaction of dimethametryne and rice cultivars on injury score was significant only at 2 WAS in both the screen house and field trials (Table 7). Rice cultivar Ex-china only exhibited significantly higher injury scores than ITA 257 with the application of dimethametryne at 1.5 to 2.5 Kgai/ha in the screen house and 1.5, 2.0 and 3.0 kgai/ha in the field. Crop injury scores increased significantly from 1.50 to 3.0 kgai/ha on both cultivars in the screen house. While dimethametryne at 2.5 and 3.0 kgai/ha resulted in similar injury scores when applied to ITA 257, the chemical at 3.0kgai/ha caused significantly higher injury than 2.50kgai/ha on Ex-china in the field (Table 7).

4.3 CROP VIGOUR SCORE

The effect of dimethametryne on crop vigour of rice plants was significant at 2, 4, 6, 8 and 10 WAS in both the screen house and field experiments. Dimethametryne at 0.25 and 0.5Kgai/ha in the screen house and 0.25 to 1.0kgai/ha in the field as well as 1.0kgai/ha at 2 WAS in the screen house resulted in crop vigour scores of rice plants comparable to that of the no-herbicide control in the study. (Table 8 and 9). While dimethametryne at 4.0 Kgai/ha resulted in significantly lower crop vigour than the lower rates at all the sampling dates in the field the same rate only caused significantly lower vigour score compared to the lower rates at 2 WAS in the screen house. Also in the screen house, the

herbicide at 3.0 to 4.0 Kgai/ha resulted in total crop loss at 3 WAS and later (Table 8). In the screen house, crop vigor at 3 WAS and later (Table 8). In the screen house, crop vigour score decreased with increasing herbicide rates from 1.50 to 3.0kgai/ha at 2 WAS, and 2.0 to 3.0 Kgai/ha at 4 to 10 WAS.

At all the sampling dates, plants of ITA 257 consistently maintained significantly higher crop vigour score than those of Ex-china both in the screen and the field (Tables 8 and 9).

The interaction of dimethametryne and rice cultivars on vigour score was significant at all the sampling dates in both studies. Plants of cultivar ITA 257 exhibited higher vigour score than Ex-China with the application of dimethametryne at 2.0 and 2.5kgai/ha at 2 WAS, 1.5 to 2.50kgai/ha at 4 WAS, 1.0, 1.5 and 2.50kgai/ha at 6 and 10 WAS, 1.0 and 2.50kgai/ha at 8 WAS in the screen house (Tables 10 and 11).

TABLE 7: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVAR INTERACTION ON CROP INJURY AT 2, WAS IN THE SCREEN HOUSE AND FIELD AT SAMARU-ZARIA - 1995

Dimethametryne Rates	Screen House		2 WAS[3]	Field
(Kgai/ha)	ITA 257	EX-CHINA	ITA 257	EX-CHINA
0.00(Control)	0.00h	0.00h	0.00g	0.00g
0.25[2]	0.00h[1]	0.00h	0.00g	0.00g
0.50	0.33h	0.00h	0.00g	0.00g
1.00	1.00g	1.33g	0.33g	2.67d
1.50	2.00f	2.67e	2.00e	2.67d
2.00	3.00e	3.67d	2.00e	2.67d
2.50	4.67c	7.00b	3.00cd	3.33c
3.00	8.00a	8.00a	3.33c	4.00b
3.50	8.00a	8.00a	4.00b	4.33b
4.00	8.00a	8.00a	5.00a	5.33a
SE(±)	0.167		0.195	

1 - Means followed by the same letter(s) within a treatment group for a particular character is not significantly different at 5% level of significance using DRMT

2 - Rates of dimethametryne

3 - Weeks after sowing;

TABLE 8: EFFECT OF DIMETHAMETRYNE ON CROP VIGOUR OF RICE CULTIVAR IN THE SCREEN HOUSE AT SAMARU-ZARIA, 1995

Experimental Treatment DIMETHAMETRYNE Rate (D) (Kgai/ha)	CROP VIOUR SCORE[1] 2WAS	4WAS	6WAS[2]	8WAS	10WAS
0.00(Control)	9.00a	8.80a	9.00a	9.00a	9.00a
0.25[3]	9.00a	9.00a[4]	9.00a	9.00a	9.00a
0.50	8.83a	9.00a	9.00a	9.00a	9.00a
1.00	7.83a	6.70b	7.20b	7.30c	7.50c
1.50	6.67c	6.30bc	7.20b	7.30c	7.50c
2.00	5.70d	5.80c	7.30b	7.80b	8.00b
2.50	5.70e	3.30d	4.50c	4.70d	5.20d
3.00	2.50f	0.00e	0.00d	0.00e	0.00e
3.50	2.17f	0.00e	0.00d	0.00e	0.00e
4.00	1.20g	0.00e	0.00d	0.00e	0.00e
SE(±)	0.167	0.140	0.175	0.106	0.075
CULTIVARS(C)					
ITA 257	5.97a	5.10a	5.50a	5.60a	5.70a
EX-CHINA	5.43b	4.70b	5.13b	5.23b	5.40b
SE(±)	0.075	0.063	0.078	0.047	0.033
INTERACTION D X C	*	*[5]	*	*	*

1 - Based on 0 -9 Scale

2 - Weeks after sowing

3 - Rates of dimethametryme

4 - Mean followed by the same letter within a treatment group is not significantly different at 5% level of significances using DMRT.

5 - Significance at 5% level

Table 9: EFFECT OF DIMETHAMETRYNE ON CROP VIGOUR OF RICE CULTIVAR IN THE FIELD AT SAMARU-ZARIA, 1995.

Experimental Treatment Dimethametryne Rates (D) (Kg/ha)	CROP VIGOUR SCORE[3] AT 2WAS[2]	4WAS	6WAS	8WAS	10WAS
0.00(Control)	9.00a	9.00a	9.00a	9.00a	9.00a
0.25[4]	9.00a[1]	9.00a	9.00a	9.00a	9.00a
0.50	9.00a	9.00a	9.00a	9.00a	9.00a
1.00	8.67a	9.00a	9.00a	9.00a	9.00a
1.50	6.67b	6.70b	7.33b	7.50b	7.50b
2.00	6.50b	6.00bc	7.17b	7.20bc	7.16bc
2.50	5.83c	5.50cd	7.33b	7.50bb	7.50a
3.00	5.33d	5.00d	6.00c	6.50c	6.50c
3.50	4.33e	3.00e	3.50d	6.50c	6.50c
4.00	3.67f	2.33e	1.67e	2.50d	2.50d
Control	9.00a	9.00a	9.00a	9.00a	9.00a
SE(±)	0.146	0.235	0.240	0.199	0.199
Cultivar(C)					
ITA 257	7.03a	6.70a	7.20a	7.60a	7.60a
Ex-china	6.56b	6.20b	6.60b	7.13b	7.13b
SE(±)	0.053	0.067	0.078	0.078	0.078
Interaction D X C	*[5]	*	*	*	*

1 - Means followed by the same letter(s) within a treatment group is/are not significantly different at 5% level of significance using DMRT
2 - Weeks after sowing
3 - Based on 0 - 9 Scale where zero is least vigorous, nine is not vigorous
4 - Rates of Dimethametryne
5 - Significant at 5% level

TABLE 10: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVAR INTERACTION ON CROP VIGOUR AT 2,4 AND 6 WAS IN THE SCREEN HOUSE AT SAMARU-ZARIA, 1995

DIMETHAMETRYNE (Kgai/ha)	2 WAS[1]		4 WAS[1]		6 WAS	
	ITA 257	EX-CHINA	ITA 257	EX-CHINA	ITA 257	EX-CHINA
0.00(Control)	9.00a	9.00a	8.70a	9.00a	9.00a	9.00a
0.25[3]	9.00a[2]	9.00a	9.00a	9.00a	9.00a	9.00a
0.50	9.00a	8.70ab	9.00a	9.00a	9.00a	9.00a
1.00	8.00bc	7.70cd	7.00b	6.33bc	7.70b	6.70c
1.50	7.00de	6.33e	6.70b	6.00c	7.70b	6.70c
2.00	6.00e	5.33f	6.33bc	5.33d	7.33bc	7.33bc
2.50	4.70f	2.70g	4.33e	2.33f	5.30d	3.70e
3.00	2.70g	2.33g	0.00g	0.00g	0.00f	0.00f
3.50	2.30g	2.00gh	0.00g	0.00g	0.00f	0.00f
4.00	2.00gh	1.33h	0.00g	0.00g	0.00f	0.00f
SE(±)	0.235		0.197		0.247	

1 - Weeks after sowing.

2 - Rates of Dimethametryne

3 - Means followed by the same letter(s) within a treatment group is/are not significant different at 5% level of significance using DMRT.

Table 11: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVAR INTERACTION ON CROP VIGOUR AT 8 AND 10 WAS IN THE SCREEN HOUSE AT SAMARU-ZARIA, 1995

Dimethametryne (Kgai/ha)	8 WAS[1]		10 WAS	
	ITA 257	EX-CHINA	ITA 257	EX-CHINA
0.00(Control)	9.00a	9.00a	9.00a	9.00a
0.25[3]	9.00a[2]	9.00a	9.00a	9.00a
0.50	9.00a	9.00a	9.00a	9.00a
1.00	8.00ab	6.70c	8.00b	7.00c
1.50	7.70bc	7.00bc	8.00b	7.00c
2.00	8.00ab	7.70bc	8.00b	7.00b
2.50	5.33d	4.00e	5.70d	4.70e
3.00	0.00f	0.00f	0.00f	0.00f
3.50	0.00f	0.00f	0.00f	0.00f
4.00	0.00f	0.00f	0.00f	0.00f
SE(±)	0.149	0.106		

1 - Weeks after sowing

2 - Means followed by the same letter(s) within a treatment group is/are not significantly different at 5% level of significance using DMRT.

3 - Rate of dimethametryne

In the field plants of ITA 257 exhibited significantly higher crop vigour score than ex-china with the application of dimethametryne at 1.5, 3.0 and 4.0kgai/ha at 6 to 10 WAS (Tables 12 and 13). The application of dimethametryne at 2.50 and 3.50 kgai/ha resulted in significantly lower crop vigor score than the herbicide at 2.0 and 3.0 Kgai/ha on ITA at 2 WAS. Similarly dimethametryne at 3.0kgai/ha resulted in significantly low vigour score that at 2.5kgai/ha on Ex-china. Crop vigour score was significantly lower with the application of dimethemetryne at 4.0 kgai/ha compared with the herbicide at 3.50kgai/ha on ITA 257 and 4.0kga/ha compared with 2.50 to 3.50kgai/ha on ex-china at 6 to 10 WAS (Tables 12 and 13).

Table 12: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVAR INTERCATION ON CROP VIGOUR AT 2, 4 AND 6 WAS IN THE FIELD AT SAMARU-ZARIA.

Experimental Treatment Dimethametryne Rates (D)	2WAS		4WAs		6WAS	
(kg ai/ha)	ITA 257	Ex-China	ITA 257	Ex-China	ITA 257	Ex-China
0.00(Control)	9.00a	9.00a	9.00a	9.00a	9.00a	9.00a
0.25[1]	9.00a[1]	9.00a	9.00a	9.00a	9.00a	9.00a
0.50	9.00a	9.00a	9.00a	9.00a	9.00a	9.00a
1.00	8.66a	8.66a	9.00a	9.00a	9.00a	9.00a
1.50	7.00b	6.33c	7.00b	6.33bc	7.66b	7.00bc
2.00	7.00b	6.00cd	6.33bc	5.70cd	7.33bc	7.00bc
2.50	6.00cd	5.67d	6.00cd	5.00de	7.25bc	6.70c
3.00	5.67d	5.00e	5.70cd	4.33ef	6.70c	5.33d
3.50	5.00e	3.66fg	3.33g	2.70gh	4.00e	3.00f
4.00	4.00f	3.33g	2.70g	2.00h	2.33f	2.00g
SE(±)	0.188		0.278		0.298	

1 - Means followed by the same letter(s) within a treatment group for a particular character is/are not significant statistically using the DMRT

2 - Weeks after sowing

3 - Rates of dmethametryne

Table 13: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVAR INTERCATION ON CROP VIGOUR AT 8 AND 10WAS IN THE FIELD AT SAMARU-ZARIA, 1995.

Experimental Treatment Dimethamethryne Rates (D)	8WAS[2]		10WAS	
(kg ai/ha)	ITA 257	Ex-China	ITA 257	Ex-China
0.00(Control)	9.00a	9.00a	9.00a	9.00a
0.25[3]	9.00a[1]	9.00a	9.00a	9.00a
0.50	9.00a	9.00a	9.00a	9.00a
1.00	9.00a	9.00a	9.00a	9.00a
1.50	7.70bc	7.33bc	7.66bc	7.33c
2.00	7.33bc	7.00c	7.33bc	7.00c
2.50	7.25bc	7.00c	7.25bc	7.00c
3.00	7.00c	6.00d	7.00c	6.00d
3.50	7.00c	6.00d	7.00c	6.00d
4.00	3.00ed	2.00f	3.00e	2.00f
SE(±)	0.265		0.266	

1 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.

2 - weeks after sowing

3 - Rates of Dimethametryne

4.4. PLANT HEIGHT.

Dimethemetryne had significant effect on the height of rice cultivars at 3,6,9 and 12 WAS in the screen house and at 3,6,and 9 was in the field (Tables 14 and 15). In all cases, dimethametryne at 0.25 to 1.50kg ai\ha in both the screen house and the field in addition 2.0kgai\ha at 6 and 9 was in the screen house, 2.5 and 3.5kgai\ha at 3 was and 2.5kgai\ha at 6 was in the field resulted in plants which were comparable in height to the no- herbicide control but significantly taller than those treated with the herbicide at 3.0 to 4.0kgai\ha (Tables 14 and 15).

In the screen house, dimethametryne at 2.0 and 2.5kgai\ha at 3 and 12 WAS and 2.50kgai\ha at 6 and 9 WAS resulted in significantly shorter plants than the appropriate maxima. Application of dimethametryne at 3.0 to 4.0kgai\ha caused total plants loss resulting from herbicide phytotoxicity (Table 14).

In the field, dimethametryne at 3.0 and 4.0kgai\ha at 3 WAS, 2.0,3.0 to 4.0kgai/ha at 6 WAS and at 2.0 to 4.0kgai/ha at 9 WAS resulted in significantly shorter plants than the no-herbicide control (Table 15).

Plants of ITA 257 were significantly taller than those of Ex-China at all the sampling dates in both studies (Tables 14 and 15). The interaction of dimethametryne and rice cultivars on plant height WAS significant at 3 and 12 WAS in the screen (Table 16) and at 3 and 6 and 10 WAS in the field (Table 17).

In the screen house, plants of ITA 257 with the application of dimethametryne at 1.0 and 1.50kgai\ha and the no-herbicide control resulted in plant height comparable with the maximum obtained at 0.25kgai\ha at 3WAS. Also at 3WAS, plants of EX-china were shorter than the tallest obtained with the dimethametryne at 0.25kgai\ha on ITA 257. At 12 WAS, dimethametryne at 0.25 to 2.0kgai/ha and the no-herbicide control on EX-china resulted in significantly shorter plants than the corresponding rates on ITA 257.

However, in field, plants of Ex-china were significantly shorter than those of ITA 257 in most cases except with the application of dimethametryne at 2.0kgai/ha at 3 and 9 WAS, when the plants of the two cultivars were similar in height (Table 17).

Table 14: EFFECT OF DIMETHAMETRYNE ON THE HEIGHT OF RICE CULTIVAR IN THE SCREEN HOUSE AT SAMARU-ZARIA, 1995

Experimental Treatment DIMETHAMETRYNE (D) (Kgai/ha)	PLANT HEIGHT AT 3 WAS[1]	6 WAS	9WAS	12WAS
0.00(Control)	22.78a	36.50ab	54.30a	76.85a
0.25[2]	23.48a[3]	36.83ab	58.00a	76.05ab
0.50	22.95a	39.18a	50.00a	76.92a
1.00	22.63a	39.38a	57.40a	76.17a
1.50	20.68ab	39.52a	60.10a	76.07ab
2.00	17.93b	38.12a	61.20a	73.30b
2.50	5.33c	30.37b	8.80b	39.50c
3.00	0.00d	0.00c	0.00b	0.00d
3.50	0.00d	0.00c	0.00b	0.00d
4.00	0.00d	0.00c	0.00b	0.00d
SE(±)	1.096	2.125	4.469	0.790
CULTIVARS(C)				
ITA 257	15.28a	29.30a	37.60	52.67a
EX-CHINA	11.88b	22.68b	32.40	38.40b
SE(±)	0.410	0.951	2.001	0.354
			NS[4]	
INTERACTION				
D X C	*[5]	N.S	N.S	*

1 - weeks after sowing
2 - Rates of (Dimethametryne)
3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.
4 - Not Significant
5 - Significant at 5% level

Table 15: EFFECT OF DIMETHAMETRYNE ON THE HEIGHT(CM) OF RICE CULTIVARS AT IN THE FIELD AT SAMARU ZARIA, 1995

Experimental Treatment DIMETHAMETRYNE(D) (Kgai/ha)	SAMPLING INTERVALS 3 WAS	6 WAS[1]	9 WAS	12 WAS
0.00(Control)	15.95ab	37.13a	64.80ab	76.70
0.25[2]	15.97a[3]	39.80a	61.75a-c	71.70
0.50	16.22a	34.53a	62.30a-c	77.40
1.00	15.45ab	40.17a	61.75a-c	77.20
1.50	16.28a	39.28a	66.97a	76.50
2.00	14.08bc	30.78b	49.75de	71.50
2.50	15.07a	37.25a	56.40bd	77.70
3.00	12.48cd	29.70b	50.28dc	71.50
3.50	16.33d	30.20b	53.25cd	69.80
4.00	10.52a	26.53b	45.98e	64.90
SE(±)	0.644	2.426	3.035	4.017
CULTIVARS (C)				
ITA 257	16.54a	40.31a	66.13a	86.50a
EX-CHINA	13.13b	28.76b	50.11b	59.90cb
SE(±)	0.257	0.770	1.081	1.423
INTERACTION D x C	*[4]	*	*	NS[5]

1 - weeks after sowing
2 - Rates of (Dimethametryne)
3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.
4 - Not Significant
5 - Significant at 5% level

Table 16: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVAR INTERACTION ON PLANT HEIGHT AT 3 AND 12 WAS IN THE SCREEN HOUSE AT SAMARU-ZARIA, 1995

DIMETHAMETRYNE (Kgai/ha)	3 WAS[1]		12 WAS	
	ITA 257	EX-CHINA	ITA 257	EX-CHINA
0.00(Control)	25.40ab	20.20bc	86.70b	67.00c
0.25[2]	25.70a[3]	21.30a-c	88.43ab	63.70c
0.50	24.90ab	21.00a-c	86.90b	66.93c
1.00	25.20ab	20.10bc	91.33a	61.00d
1.50	22.00a-c	19.33c	88.60ab	63.60cd
2.00	19.00c	16.90c	84.80b	61.80d
2.50	10.70d	7.20d	19.50e	16.10e
3.00	0.00e	0.00e	0.00f	0.00f
3.50	0.00e	0.00e	0.00f	0.00f
4.00	0.00e	0.00e	0.00f	0.00f
SE(±)	1.550		1.117	

1 - weeks after sowing
2 - Rates of (Dimethametryne)
3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.

TABLE 17: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVARS INTERACTION ON HEIGHT AT 3,6,9 WAS IN THE FIELD AT SAMARU-ZARIA

DIMETHAMETRYNE (Kgai/ha)	3 WAS[1] ITA 257	3 WAS[1] EX-CHINA	6 WAS[1] ITA 257	6 WAS[1] EX-CHINA	9 WAS ITA 257	9 WAS EX-CHINA
0.00(Control)	17.67a	14.23cd	42.43a-d	31.83e-f	70.70a-c	58.93c-f
0.25[2]	17.60a	14.33cd	47.80a[3]	31.80e-h	80.30a	59.20c-f
0.50	18.07a	14.37cd	39.90a-e	29.20f-h	70.00a-d	54.60e-g
1.00	17.00ab	13.90cd	46.00a	34.33b-g	69.60a-d	53.90c-h
1.50	17.80a	14.77b-d	44.77ab	33.80d-g	74.93ab	59.00c-f
2.00	14.93b-d	13.23cd	31.42e-h	30.13f-h	53.70e-h	45.80g-h
2.50	16.20b-c	13.93cd	43.03a-c	29.50f-h	61.13c-f	51.67f-h
3.00	14.30cd	10.67e	33.70d-g	25.70g-i	58.90d-f	43.70gi
3.50	18.20a	14.47cd	37.73b-f	22.70hi	64.20b-e	42.30hi
4.00	13.67cd	7.37f	34.30c-g	18.73i	59.90c-f	32.10i
SE(±)	0.862		2.975		3.881	5.20

1 - weeks after sowing

2 - Rates of (Dimethametryne)

3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.

4.5 LEAF AREA\PLANT (LA\PLANT).

The effect of dimethametryne on the leaf area\plant of rice cultivars was significant at 8 and 12 WAS in the screen house and at 4,8 and 12 WAS in the field (Tables 18 and 19).

In the screen at 8 and 12 WAS, dimethametryne at 1.5kgai\ha at 8 WAS and at 0.50kgai\ha at 12 WAS resulted in significantly higher LA/plant compared with the herbicide at 0.25kgai/ha at 8 WAS and the herbicide at 2.5kgai/ha at 12 WAS.

In the field, dimethametryne at 4.0kgai\ha resulted in significantly lower LA\plant than the no - herbicide control at 4 WAS and all the other treatments at 8 and 12 WAS. Although LA\plant was lower with dimethametryne at 0.5,2.0 and 3.00kgai/ha compared with the control at 3WAS, the parameter was similar for all the treatments except dimethametryne at 1.50kgai\ha at 12 WAS.

The cultivar ITA 257 produced significantly higher LA\plant compared with Ex-china at all the sampling dates in both studies (Tables 18 and 19).

The interaction of dimethametryne and rice cultivars on LA/plant was significant at 12 WAS in the screen house and at all the sampling dates in the field (Table 20 and 21). In the screen house, the two cultivars produced similar LA\plant except with the application of dimethametryne at 2.0 and 2.5kgai\ha where Ex-china produced significantly lower LA\plant than ITA 257. Also, application of dimethametryne at 2.5kgai\ha resulted in significantly lower LA/plant at 2.0kgai/ha on ITA 257 (Table 20).

Table 18: EFFECT OF DIMETHAMETRYNE ON LEAF AREA/PLANT OF RICE CULTIVAR IN THE SCREEN HOUSE AT SAMARU - ZARIA, 1995

Experimental Treatment DIMETHAMETRYNE(D) (Kgai/ha)	LEAF AREA/PLANT AT 4 WAS[1]	8 WAS	12 WAS
0.00(Control)	1.08	2.77ab	3.82bc
0.25[2]	1.15	2.28b[3]	4.12a-c
0.50	0.93	2.77ab	4.62a
1.00	1.13	2.40ab	4.22a-c
1.50	1.08	2.88a	4.13a-c
2.00	0.98	2.67ab	4.33ab
2.50	1.12	2.75ab	3.67c
3.00	0.00	0.00c	0.00d
3.50	0.00	0.00c	0.00d
4.00	0.00	0.00c	0.00d
SE(±)	0.068	0.138	0.140
Significance	NS[4]		
CULTIVARS(C)			
ITA 257	0.83a	2.02a	3.12a
EX-CHINA	0.67b	1.68b	2.66b
SE(±)	0.031	0.062	0.063
INTERACTION			
D x C	N.S	N.S	*[5]

- weeks after sowing
- Rates of (Dimethametryne)
- Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.
- Not Significant
- Significant at 5% level

Table 19: EFFECT OF DIMETHAMETRYNE ON LEAF AREA/PLANT (CM^2) OF RICE CULTIVARS IN THE FIELD HOUSE AT SAMARU-ZARIA, 1995

Experimental Treatment			
DIMETHAMETRYNE (Kgai/ha)	LEAF AREA/PLANT AT 4 WAS[1]	8 WAS	12 WAS
0.00(Control)	1.50b	2.75b	3.27b
0.25[2]	1.38bc[3]	2.48bc	3.27b
0.50	1.45b	2.20c	3.03b
1.00	1.37bc	2.38bc	3.23b
1.50	2.18a	3.40a	4.50a
2.00	1.23bc	2.23c	2.72b
2.50	1.52b	2.38bc	3.02b
3.00	1.37bc	2.22c	2.68b
3.50	1.57b	2.55bc	3.12b
4.00	0.92c	1.43d	1.92cb
SE(±)	0.134	0.159	0.193
CULTIVARS(C)			
ITA 257	1.69a	2.69a	3.43a
EX-CHINA	1.20b	2.11b	2.72b
SE(±)	0.079	0.091	0.122
INTERACTION			
D x C	*	*[4]	*

1 - weeks after sowing
2 - Rates of (Dimethametryne)
3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.
4 - Not Significant

Table 20: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVAR INTERACTION ON LEAF AREA/PLANT AT 12WAS IN THE SCREEN HOUSE AT SAMARU - ZARIA, 1995

DIMETHAMETRYNE (Kgai/ha)	12 WAS[1] ITA 257	EX-China
0.00(Control)	4.40a-c	3.23de
0.25[2]	4.37a-c[3]	3.87c-e
0.50	4.90a	4.33a-c
1.00	4.27a-c	4.17b-d
1.50	4.37a-c	3.90dc
2.00	4.87ab	3.50de
2.50	4.07cd	3.27e
3.00	0.00f	0.00f
3.50	0.00f	0.00f
4.00	0.00f	0.00f
SE(±)	0.198	

1 - weeks after sowing
2 - Rates of (Dimethametryne)
3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.

In the field, rice cultivars Ex-china produced significantly lower LA\plant compared with no-herbicide at all the dates with the application of dimethametryne at 4.0kgai\ha at 4 and 8 WAS. However, dimethametryne at 1.5kgai\ha on Ex-china resulted in significantly higher LA\plant than the same rate on ITA 257 at 8 WAS (table 21).

4.6. TILLER NUMBER\PLANT.

The effect of dimethametryne on tiller number\plant of rice cultivars was significant at 6,8,10 and 12 WAS in both the screen house and field studies (tables 22 and 23). In the screen house at all the sampling dates, dimethametryne at 2.5 and 4.0kgai\ha resulted in significantly lower tiller number\plant than the no-herbicide control.

At 6 WAS, dimethametryne at 0.25kgai\ha resulted in significantly higher tiller number\plant than the no-herbicide control and all other treatments except 0.5 and 1.5kgai\ha. At 8 to 12WAS, dimethametryne at 0.25rto 2.0 kgai\ha resulted in similar higher tiller number\plant than rate 2.5kgai\ha. There was no tillering with dimethametryne at 3.0 to 4.0kgai\ha at all the sampling dates (Table 22).

TABLE 21: EFFECT DIMETHAMETRYNE AND RICE CULTIVARS INTERACTION ON LEAF AREA/PLANT(Cm^2) AT 4,8 AND 12 WAS IN THE FIELD HOUSE AT SAMARU-ZARIA, 1995

DIMETHAMETRYNE (Kgai/ha)	4 WAS		8 WAS[1]		12 WAS	
	ITA 257	EX-CHINA	ITA 257	EX-CHINA	ITA 257	EX-CHINA
0.00(Control)	2.20ab	0.80gh	3.70ab	1.80de	4.27ab	2.27gh
0.25[2]	1.73b-e[3]	1.03e-h	3.00b-c	1.97eg	4.03a-c	2.50e-h
0.50	1.60b-f	1.30d-g	2.27c-g	2.13dg	3.13c-g	2.93d-h
1.00	1.60b-f	1.13e-h	2.60c-f	2.17dg	3.43b-e	3.03c-g
1.50	1.97a-c	2.40a	2.83cd	3.97a	4.20a-b	4.80a
2.00	1.37c-g	1.10e-h	2.47c-g	2.00d-g	2.97d-g	2.47e-h
2.50	1.66b-f	1.37c-g	2.70c-f	2.07d-g	3.53b-d	2.50e-h
3.00	1.86a-d	0.87gh	2.70c-f	1.73f-g	3.00c-g	2.37e-g
3.50	1.60b-f	1.53c-f	2.73c-e	2.37c-g	3.30b-f	2.93d-g
4.00	1.33c-g	0.50h	1.93eg	0.93h	2.47e-h	1.93h
SE(±)		0.212		0.256	0.334	

1 - weeks after sowing

2 - Rates of (Dimethametryne)

3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.

Table 22: EFFECT OF DIMETHAMETRYNE ON TILLER NUMBER PER PLANT OF RICE CULTIVAR IN THE SCREEN HOUSE AT SAMARU ZARIA, 1995

Experimental Treatment				
DIMETHAMETRYNE Rates (D) (Kgai/ha)	TILLER NUMBER/PLAT AT 6 WAS	8 WAS[1]	10 WAS	12WAS
0.00(Control)	2.00b	3.50a	3.50a	3.50a
0.25[2]	2.30a[3]	3.50a	3.50a	3.50a
0.50	2.20ab	3.50a	3.50a	3.50a
1.00	2.00b	3.20a	3.50a	4.00a
1.50	2.20ab	3.20a	3.50a	4.00a
2.00	2.00b	3.30a	3.50a	4.00a
2.50	0.50c	0.50b	0.50b	0.50b
3.00	0.00d	0.00c	0.00c	0.00c
3.50	0.00d	0.00c	0.00c	0.00c
4.00	0.00d	0.00c	0.00c	0.00c
SE(±)	0.091	0.183	0.158	0.158
CULTIVARS (C)				
ITA 257	1.20	1.70b	1.90b	1.90a
EX-CHINA	1.30	2.40a	2.40a	2.70a
SE(±)	0.041	0.082	0.071	0.071
Significance	NS[4]			
INTERACTION				
D x C	NS	*[5]	*	*
SIGNIFANCE	NS	**	**	**

1 - weeks after sowing
2 - Rates of (Dimethametryne)
3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.
4 - Not Significant
5 - Significant at 5% level

In the field, the application of dimethametryne at only 4.0kgai\ha resulted in significantly lower tiller number\plant than the appropriate maxima at 6 and 8 WAS. However, dimethametryne at 1.0,2.5,3.0 and 4.0kgai\ha at 10 WAS and 1.0,3.0 and 4.0kgai/ha at 12 WAS resulted in significantly lower tiller number/plant than the appropriate maxima (Table 23).

The differences in tiller number\plant between the rice cultivars were significant at 8,10 and 12 WAS in the screen house and at 6 WAS in the field. At all these dates in both studies, Ex-china produced significantly higher tiller number\plant compared with ITA 257 (Tables 22 and 23).

The interaction of dimethametryne and rice cultivars on tiller number\plant was significant in the screen house at 8,10 and 12 WAS (Table 24). Here, the application of dimethametryne at 1.0 to 2.0kgai\ha on Ex-china produced significantly higher tiller number\plant than on ITA 257. The two cultivars were similar in this parameter with all the other treatments at all the sampling dates (table 24).

4.7. SHOOT DRY WEIGHT.

The effect of dimethametryne on shoot dry weight of rice cultivars was significant at 6.10 and 12 WAS in the screen house and at 6 WAS in the field (Tables 25 and 26).

In the screen house at 6 WAS, dimethametryne at 0.5,1.0 and 2.5kgai\ha resulted in significantly lower shoot dry weight than the maximum obtained with the no-herbicide control. No shoot dry weight was obtained with 3.0 to 4.0kgai/ha at 6,10 and 12 WAS due to total plants loss.

At 10 and 12 WAS, dimethametryne at 1.0kgai/ha resulted in significantly higher but comparable shoot dry weight with those obtained at all the other herbicide treatments including the no-herbicide control except 0.25kgai\ha at 10WAS, 2.0 and 2.5kgai/ha at 12 WAS (Table 25).

In the field, dimethametryne at 3.5 and 4.0 Kgai/ha resulted in significantly lower shoot dry weight than the maximum obtained at 0.25, 1.0 and 1.50Kgai/ha. Dimethametryne at 4.0kgai/hi also resulted in significantly lower shoot dry weight than the herbicide at 0.5 and 2.5kgai/ha (Table 26).

The rice cultivar ITA 257 produced significantly higher shoot dry weight compared with Ex-china at 8,10 and 12 WAS in the screen house and at all the sampling dates in field (Tables 25 and 26).

The interaction of dimethametryne and rice cultivars on shoot dry weight was not significant in the screen house but was significant at 6 and 10 WAS in the field (Table 27).

Plants of Ex-china produced significantly lower shoot dry weight than ITA 257 with the application of dimethametryne at 2.5 and 3.0kgai/ha at 6 WAS, 1.0 and 2.5 kgai/ha at 10 WAS, while the two cultivars were similar in shoot dry weight with the other cultivars were similar in shoot dry weight with the other herbicide treatments at 6 and 10 WAS (Table 27)

Table 23: EFFECT OF DIMETHAMETRYNE ON TILLER NUMBER PER PLANT OF RICE CULTIVARS IN THE FIELD AT SAMARU ZARIA, 1995

Experimental DIMETHAMETRYNE Rates (D) (Kgai/ha)	TILLER NUMBER/PLANT AT 6 WAS	8 WAS[1]	10WAS	12 WAS
0.00(Control)	1.70a	2.00ab	3.00ab	3.00ab
0.25[2]	1.50a[3]	2.20ab	2.30c	2.70a-c
0.50	1.70a	2.30ab	3.20a	3.20a
1.00	1.80a	2.50a	2.50bc	2.50bc
1.50	1.70a	2.20ab	2.80a-c	2.80a-c
2.00	1.70a	2.30ab	3.00ab	3.00ab
2.50	1.70a	2.20ab	2.80a-c	2.80a-c
3.00	1.30a	2.00ab	2.30c	2.20c
3.50	1.70a	2.00ab	2.70a-c	2.70a-c
4.00	1.00b	1.70b	2.50bc	2.50bc
SE(±)	0.181	0.194	0.199	0.194
CULTIVARS(C)				
ITA 257	1.20b	2.10	2.60	2.60
EX-CHINA	1.80a	2.20	2.90	2.90
SE(±)	0.078	0.071	0.097	0.097
Significance	*[4]	NS	NS	NS
INTERACTION				
D x C	NS[5]	NS	NS	NS

1 - weeks after sowing
2 - Rates of (Dimethametryne)
3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.
4 - Not Significant
5 - Significant at 5% level

TABLE 24: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVAR INTERACTION ON TILLER NUMBER/PLANT AT 8,10, AND 12 WAS IN THE SCREEN HOUSE AT SAMARU-ZARIA

DIMETHAMETRYNE (Kgai/ha)	8 WAS		10 WAS[1]		12 WAS	
	ITA 257	EX-CHINA	ITA 257	EX-CHINA	ITA 257	EX-CHINA
0.00(Control)	3.00ab	4.00a	3.00b	4.00a	3.00c	4.00b
0.25[2]	3.00ab[3]	4.00a	3.00a	4.00a	3.00c	4.00b
0.50	3.00ab	4.00a	3.00a	4.00a	3.00c	4.00b
1.00	2.30b	4.00a	3.00b	4.00a	3.00c	5.00a
1.50	2.30b	4.00a	3.00b	4.00a	3.00c	5.00a
2.00	2.70b	4.00a	3.00b	4.00a	3.00c	5.00a
2.50	1.00c	1.00c	1.00c	1.00c	1.00d	1.00d
3.00	0.00d	0.00d	0.00d	0.00d	0.00e	0.00e
3.50	0.00d	0.00d	0.00d	0.00d	0.00e	0.00e
4.00	0.00d	0.00d	0.00d	0.00d	0.00e	0.00e
SE(±)	0.258		0.224		0.224	

1 - weeks after sowing

2 - Rates of (Dimethametryne)

3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.

Table 25: EFFECT OF DIMETHAMETRYNE ON SHOOT DRY WEIGHT (Kg/ha PLANTS) OF RICE CULTIVAR AT 4 SAMPLING INTERVALS IN THE SCREEN HOUSE AT SAMARU ZARIA, 1995

Experimental Treatment				
DIMETHAMETRYNE Rates (D) (Kgai/ha)	SHOOT DRY WEIGHT AT 6 WAS	8 WAS[1]	10 WAS	12WAS
0.00(Control)	2.52a	4.50	17.27ab	23.93ab
0.25[2]	2.10ab[3]	4.42	16.08b	23.73ab
0.50	1.90b	4.23	17.42ab	23.52ab
1.00	1.93b	4.33	20.87a	24.30a
1.50	2.27ab	3.20	17.20ab	22.82ab
2.00	2.08ab	4.55	17.73ab	21.50b
2.50	1.90b	4.20	17.15ab	21.42b
3.00	0.00c	0.00	0.00c	0.00c
3.50	0.00c	0.00	0.00c	0.00c
4.00	0.00c	0.00	0.00c	0.00c
SE(±)	0.153	0.295	1.117	0.769
Significance		NS[4]		
CULTIVARS(C)				
ITA 257	1.30	1.01a	11.97a	14.50a
EX-CHINA	1.25	2.43b	9.34b	13.46b
SE(±)	0.068	0.132	0.499	0.344
Significance	NS			
INTERACTION				
D x C	NS	NS	NS	NS

1 - weeks after sowing

2 - Rates of (Dimethametryne)

3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.

4 - Not Significant

Table 26: EFFECT OF DIMETHAMETRYNE ON PADDY YIELD AND SHOOT DRY WEIGHT OF RICE CULTIVARS IN THE FILED AT SAMARU ZARIA, 1995

Experimental Treatment					
DIMETHAMETRYNE Rates (D) (Kgai/ha)	SHOOT DRY WEIGHT AT 6 WAS	8 WAS[1]	10 WAS	12 WAS	PADDY YIELD
0.00(Control)	1.97a-c	6.32	12.18	19.43	779bc
0.25[2]	2.45a[3]	5.98	11.93	19.77	1049a
0.50	2.23ab	6.10	11.48	20.07	1082a
1.00	2.53a	6.75	12.70	20.20	839b
1.50	2.42a	6.22	11.73	19.48	722bc
2.00	1.77a-c	5.73	10.30	18.78	753bc
2.50	2.35ab	6.67	12.08	19.97	583bc
3.00	1.77a-c	5.70	11.48	20.13	302d
3.50	1.58bc	5.55	10.53	18.93	159de
4.00	1.28c	5.00	9.60	17.11	54e
SE(±)	0.250	0.572	0.782	1.071	56.6478
SIGN.	*	NS	NS	NS	
CULTIVARS(C)					
ITA 257	2.35a	6.84a	12.15a	20.18a	673a
EX-CHINA	1.72b	5.15b	10.42b	18.32b	592b
SE(±)	0.063	0.250	0.364	0.501	23.4088
INTERACTION					
D x C	*[5]	NS	*	NS	NS

1 - weeks after sowing
2 - Rates of (Dimethametryne)
3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.
4 - Not Significant
5 - Significant at 5% level

Table 27: EFFECT OF DIMETHAMETRYNE AND RICE CULTIVAR INTERACTION ON SHOOT DRY WEIGHT AT 6 AND 10 WAS IN THE FIELD AT SAMARU-ZARIA, 1995

DIMETHAMETRYNE (Kgai/ha)	6 WAS[1] ITA 257	6 WAS[1] EX-CHINA	10 WAS ITA 257	10 WAS EX-CHINA
0.00(Control)	2.20a-f	1.53dg	12.43a-c	11.20a-c
0.25[2]	2.43a-d[3]	2.47a-d	13.20ab	10.70bc
0.50	2.47a-d	2.00a-f	12.70a-c	10.50bc
1.00	2.83ab	2.23a-e	8.00b	7.00c
1.50	2.77a-c	2.07a-f	12.87ab	10.63bc
2.00	2.00a-f	1.53d-g	10.63bc	9.97cd
2.50	2.87a	1.83b-g	13.63a	10.55bc
3.00	2.30a-d	1.23eg	11.90a-c	11.07a-c
3.50	2.00a-f	1.17fg	10.90a-c	10.13c
4.00	1.77c-g	0.90g	10.77bc	6.13cd
SE(±)	0.289		0.77b	

1 - weeks after sowing
2 - Rates of (Dimethametryne)
3 - Means followed by the same letter(s) within a treatment group is/are not significantly difeerent at 5% level of Significance using DMRT.

4.8. PADDY YIELD AT HARVEST.

The effect of dimethametryne on paddy yield at harvest was significant (Table 26). Dimethametryne at 0.25 and 0.5kgai\ha resulted in significantly higher paddy yield than the no-herbicide control and the higher herbicide rates. The application of dimethametryne at 1.0 to 2.5kgai\ha resulted in paddy yield comparable to the no-herbicide control. While the yields obtained with dimethametryne at 3.0 and 3.50kgai\ha were similar but were significantly higher than at 4.0kgai\ha. The cultivars ITA 257

produced significantly higher than 4.0kgai\ha.

The cultivar ITA 257 produced significantly higher paddy yield compared with Ex-china (Table 26). The interaction of dimethametryne and rice cultivars on paddy yield was not significant (Table 26).

4.9.0. CORRELATION

Results of correlation of shoot dry weight at 12 WAS with various parameters of rice in the screen house showed a significant positive correlation with crop vigour at 4,6,8 and 10 WAS, tiller number/plant at 8 and 12 WAS, and shoot dry weight at 4 and 8 WAS. However, shoot dry weight at 12 WAS significantly correlation negatively with crop injury at 3WAS. There was no correlation between shoot dry weight at 12 WAS and crop emergence at 10 WAS (Table 28).

Similarly, in the field, significant positive correlation occured between paddy yield at harvest and crop vigour at 4, 6, 8, and 10WAS, plant hieght at 6 and 12WAS, LA/Plant at 8 and 12WAS, Tiller number/plant at 8 and 12WAS and shoot dry weight at 4, 8 and 12WAS (Table 29). However, significant negative correlation occured between paddy yield and crop injury at 3WAS. There was no correlation between crop emergence at 10DAS and paddy yield at harvest in the field.

TABLE 28: CORRELATION OF VARIOUS PARAMETERS WITH DRY WEIGHT AT 12 WAS IN THE SCREEN HOUSE IN 1995 AT SAMARU

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Emergence Score	1.0000														
10 DAS															
INJURY SCORE															
3WAS	-0.0007	1.0000													
CROP VIGOUR	-0.0165	-0.9360**	1.0000												
4WAS															
CROP VIGOUR	-0.0129	-0.8817**	0.9841**	1.0000											
6WAS															
CROP VIGOUR	-0.0234	-0.8691**	0.9793**	0.9956**	1.0000										
8WAS															
CROP VIGOUR	-0.0225	-0.8555**	0.9715**	0.9920**	0.9372**	1.0000									
10 WAS															
HT AT 6 WAS	-0.1555	-0.7245**	0.8725**	0.9163**	0.9237**	0.9372**	1.0000								
HT AT 12 WAS	-0.0674	-0.8287**	0.8998**	0.8996**	0.9052**	0.8952**	0.8439**	1.0000							
LA AT 8 WAS	-0.1540	-0.5613**	0.8359**	0.8855**	0.8929**	0.9075**	0.9332**	0.7490**	1.0000						
LA AT 12 WAS	-0.1016	-0.7266**	0.8895**	0.9322**	0.9405**	0.9493**	0.9531**	0.8282**	0.9552**	1.0000					
TILLER AT 8 WAS	-0.1586	-0.7747**	0.8783**	0.8679**	0.8727**	0.8736**	0.7560**	0.8219**	0.7094**	0.7656**	1.0000				
TILLER AT 12 WAS	-0.1896	-0.6990**	0.8286**	0.8394**	0.8446**	0.8464**	0.7534**	0.8170**	0.7062**	0.7658**	0.9794**	1.0000			
DRY WT. AT 4 WAS	-0.0533	-0.7851**	0.8582**	0.8605**	0.8566**	0.8579**	0.8196**	0.8600**	0.7755**	0.7817**	0.8592**	0.8369**	1.0000		
DRY WT. AT 8 WAS	-0.0312	-0.7582**	0.8479**	0.8616**	0.8662**	0.8519**	0.8221**	0.9555**	0.7211**	0.7847**	0.8161**	0.8256**	0.8605**	1.0000	
DRY WT.AT 12 WAS	-0.0417	-0.8449**	0.9156**	0.9127**	0.9155**	0.9040**	0.8279**	0.9726**	0.7297**	0.8134**	0.8945**	0.8906**	0.8817**	0.9441**	1.0000

DF = 58

** Significant at 1% only
5%(r) = 0.255
1%(r) = 0.331

1 - Emergence Score at 10 DAS
2 - Crop injury at 3 WAS
3 - Crop Vigour at 4 WAS
4 - Crop Vigour at 6 WAS
5 - Crop Vigour at 8 WAS
6 - Crop Vigour at 10 WAS
7 - Height at 6 WAS
8 - Height at 12 WAS
9 - Leaf area at 8 WAS
10 - Leaf area at 12 WAS
11 - Tiller at 8 WAS
12 - Tiller at 12 WAS
13 - Dry Weight at 4 WAS
14 - Dry Weight at 8 WAS
15 - Dry Weight at 12 WAS

TABLE 29: CORRELATION OF VARIOUS PARAMETERS OF RICE CULTIVARS WITH PADDY YIELD AT HARVEST IN THE FIELD AT SAMARU ZARIA IN 1995

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Emergence Score	1.0000															
10 DAS																
INJURY SCORE																
3WAS	-0.0440	1.0000														
CROP VIGOUR	-0.0183	-0.9206**	1.0000													
4WAS																
CROP VIGOUR	-0.0137	-0.7897**	0.9497**	1.0000												
6WAS																
CROP VIGOUR	-0.0183	-0.7359**	0.8842**	0.9331**	1.0000											
8WAS																
CROP VIGOUR	-0.0183	-0.7359**	0.8842**	0.9931**	1.0000**	1.0000										
10 WAS																
HT AT 6 WAS	-0.2225	-0.4851**	0.4891**	0.5162**	0.5326**	0.5326**	1.0000									
HT AT 12 WAS	-0.3956*	-0.2825*	0.3281*	0.3735*	0.4068**	0.4068**	0.8349**	1.0000								
LA AT 8 WAS	-0.0260	-0.2021	0.2451*	0.3295*	0.4332**	0.4332**	0.5049**	0.4685**	1.0000							
LA AT 12 WAS	-0.0334	-0.2898*	0.3132*	0.3778*	0.4721**	0.4721**	0.5795**	0.4941**	0.95533**	1.0000						
TILLER AT 8 WAS	-0.0446	-0.2682*	0.3698*	0.4178**	0.4597**	0.4597**	0.1054	0.1829	0.2421*	0.2626*	1.0000					
TILLER AT 12 WAS	-0.1422	-0.2171	0.2156	0.2171*	0.2669*	0.2669*	0.1466	0.1964	0.1824	0.1817	0.4851**	1.0000				
DRY WT. AT 4 WAS	-0.0004	-0.3557*	0.4647**	0.5054**	0.5615**	0.5615**	0.4622**	0.4259**	0.3432*	0.3931*	0.3997*	0.3034*	1.0000			
DRY WT. AT 8 WAS	-0.0740	-0.2763*	0.3015*	0.3641*	0.4142*	0.4142*	0.6857**	0.7396**	0.5005**	0.5y11**	0.2213	0.0552	0.4077**	1.0000		
DRY WT.AT 12 WAS	-0.1816	-0.2833*	0.3576**	0.4310**	0.5277**	0.5277**	0.6473**	0.7034**	0.4294**	0.4677**	0.5111**	0.3945*	0.5312**	0.6223**	1.0000	
PADDY YIELD	0.0217	-0.7797**	0.8765**	0.8707**	0.7994**	0.7994**	0.4427**	0.2942*	0.2792*	0.3492*	0.3308*	0.2216	0.3366**	0.2710*	0.3121*	1.0000

DF = 58

* & ** Significant at 5% and 1% levels respectively

5%(r) = 0.255

1%(r) = 0.331

1	-	Emergence Score at 10 DAS	7	-	Height at 6 WAS
2	-	Crop injury at 3 WAS	8	-	Height at 12 WAS
3	-	Crop Vigour at 4 WAS	9	-	Leaf area at 8 WAS
4	-	Crop Vigour at 6 WAS	10	-	Leaf area at 12 WAS
5	-	Crop Vigour at 8 WAS	11	-	Tiller at 8 WAS
6	-	Crop Vigour at 10 WAS	12	-	Tiller at 12 WAS
13	-	Dry Weight at 4 WAS	14	-	Dry Weight at 8 WAS
15	-	Dry Weight at 12 WAS	16	-	Paddy yield at Harvest

CHAPTER FIVE

5.0. DISCUSSION

The maximum paddy yield of 1082kg\ha obtained with the application of dimethametryne at o.5kgai\ha in the study conducted at Samaru Zaria, Nigeria compares favourably with a range of 0.76 to 1.2t\ha earlier reported for rice (Abubakar,1991) at the same location. The good performance of the crop could be attributed to the adequate management practices, favourable rainfall of about 850.5mm coupled with the stimulatory activity of herbicides at low to medium rates (Weidman and Appley,1972). However, wide rice paddy yield range of 54 to 1082kg\ha in the study may be attributed to the phytotoxic effect of high rates of dimethametryne on the rice cultivars. This supports earlier report by Anon (1985). However, dimethametryne alone or\and in combination with other herbicides is known to give good control of both broadleaved, grassy weeds and emerging striga and it is well tolerated by crops such as rice, maize, sorghum, sugarcane and cotton (Anon,1985; Anon,1988; Yayock,1988; Fadayomi,1996).

5.1. EFFECT OF DIMETHAMETRYNE ON THE PERFORMANCE OF RICE CULTIVARS.

In the study, dimethametryne had significant effect on the performance of rice cultivars as reflected in crop injury, crop vigour, plant height, LA\Plant, tiller number\plant shoot dry weight and paddy yield. However, the herbicide did not have any significant effect on the emergence of rice seedlings when applied pre-emergence in the study. Anon (1988) found no significant effect on the emergence of cotton seedling with the application of dimethametryne. Dimethametryne was phototoxic to rice crop at rates of 1.5kgai\ha in the screen house and 1.50kgai\ha in the field and above as reflected in the increased crop injury and depression in crop vigour compared with the no-herbicide control. Crop injury however, further intensified at 3 and 4WAS in the screen house with dimethametryne at 0.5kgai\ha also causing significant injury to rice plants. In the field, while dimethametryne at 4.0kgai\ha caused higher Phytotoxicity than the lower rates at 2WAS, the herbicide at 2.0kgai\ha and above resulted in injury scores comparable to 4.0kgai\ha at more advanced stages of crop growth i.e.3 and 4WAS. It is therefore apparent that the effect of dimethametryne intensified in the rice plants as the crop advanced in growth from emergence to later stages especially in the screen house. The difference in the

reaction of rice to the herbicide in the screen house compared with the field may be attributed to the fact that, there was a controlled watering to only field capacity in the screen house which may not be enough to leach the herbicide away from the plants root zone. However, in the field the intensive rain may result in high mobilization and leaching of herbicide beyond the root zones of the plants with consequent high tolerance of the plants to the higher rates of the herbicide in the field than in the screen house. This is in line with the earlier report by Noriel and Mercado (1981) that phytotoxicity of herbicide to rice was higher in pot experiment than in the field.

The observed trend where vigour depression was caused by lower rate in the screen house than in the field at later stages of growth could be attributed to the explanation given for the injury score. Several other workers have reported similar decreased crop vigour at higher herbicide rates and at later stages of rice growth (Chinawang *et al*, 1987; Ramose and Alves,1988).

Plant height was obviously less sensitive to herbicide rates than injury and vigour scores. Shorter plants were caused by dimethametryne at 2.0kgai\ha and above in both screen house and field up to 9WAS after which no significant effect was observed. However, dimethametryne at 2.50kgai\ha significantly depressed

tiller number\plant until 12WAS in both screen house and field.

Dimethametryne at 2.5 to 3.0kgai\ha (Gills et al,1985), 3.0kgai\ha (Fukushima et al,1992) and at 4.0kgai\ha (Imeokparia, 1990) have been reported to depressed yield parameter of rice.

Leaf area\plant, tillering and shoot dry weight were consistently depressed by dimethametryne at 3.0 and above in the screen house until 12WAS. Similarly, significant paddy yield reduction was caused by dimethametryne at 3.0 to 4.0kgai\ha compared to the lower rates including the no-herbicide control in the field. The reduction in LA\plant, tillering and shoot dry weight hence, photosynthetic apparatus and consequently yield by the higher rates of the herbicide can be attributed to the persistence toxic effect of the herbicide even up to maturity. Several workers have reported significant reduction in rice LA\plant, shoot dry weight and paddy yield due to herbicide treatments (Gills *et al*, 1985; Smith, 1988; Imeokparia, 1990). The consistent trend on the effect of dimethametryne on the growth parameters of rice observed in the screen house compared with the field may be attributed to a number of exogenous factors on the field which might not be related to the experiment. Some of those factors were however less prevalent in the controlled trial conducted in the screen house. Inspite

of the depression in growth vigour caused by the herbicide at 1.50 to 2.50kgai\ha, paddy yields of crops treated with dimethametryne at 1.0 to 2.50kgai\ha were comparable to that of the no-herbicide control. This suggests that the crop was able to overcome the initial depression at the rates indicated. However, the higher rates of 3.0kgai\ha and above which were observed to cause serious depression in tillering, LA\plant and shoot dry matter production in the screen house, also caused significant yield reduction compared with the no-herbicide control in the field.

Tiller number has been implicated as a strong attribute of yield in rice through increase in the number of panicles while LA and shoot dry matter a photosynthetic apparatus for the production of assimilates for grain production in the crop. Any factor which adversely affects the growth and yield parameter would definitely cause significant yield depression.

It is significant to note that paddy yield was significantly higher with the application of dimethametryne at 0.25 and 0.50kgai\ha compared with the no-herbicide control which supports the earlier indication that some herbicides increase yield of crops at low to medium rates (Weidman and Appley,1972).

5.2. PERFORMANCE OF RICE CULTIVARS

In the study, Ex-China recorded significantly higher emergence score compared with ITA257. This result confirmed an earlier germination test conducted prior to the commencement of the experiment where Ex-China recorded 100% germination compared with 90% by ITA 257. This difference in seedling emergence may be due to difference in seed viability between the two cultivars.

In all cases, Ex-China exhibited significantly higher injury and lower vigour than ITA257. This may be due to the fact that ITA257 have the ability to convert dimethametryne into harmless metabolites resulting in higher tolerance. Differential suspectibility among rice cultivars to dimethametryne was linked to differential absorption and slower rate of metabolism of the herbicide (Moody and Madrib,1984; Chinwang et al, 1987). Similarly, ITA 257 produce significantly higher LA\plant, shoot dry matter, paddy yield and had taller plants than Ex-china. However, Ex-china produced significantly higher tiller number per plant than ITA 257. The difference between the two cultivars in these parameters cannot be soley herbicidal effect but also genetical. Genetically, ITA 257 is a tall cultivar and known to produce high LA\plant while Ex-China is genetically high tillering (Anon,1985).

The high paddy yield observed on ITA 257 compared to Ex-China may be due to its (ITA257) higher tolerance

characters resulting in earlier good establishment and growth. Though Ex-China produced significantly higher tiller number than ITA 257, which is an important yield parameter in rice, these tillers were ineffective probably due to adverse herbicide effect on Ex-China as reflected in injury and crop vigour.

5.3. INTERACTION OF RATES OF DIMETHAMETRYNE AND RICE CULTIVARS ON THE PERFORMANCE OF RICE.

Significant interaction of rates of dimethametryne and rice cultivars was observed on all the parameters in the studies except crop emergence at 10DAS (screen house and field), crop injury at 3 and 4WAS (screen house and field), plant height at 6 and 9WAS (screen house) and at 12WAS (field), leaf area\plant at 4 and 8WAS (screen house), tiller number\plant at all the dates(field) and at 6WAS (screen house), shoot dry weights at all the dates (screen house) and at 8 and 12WAS (field) and paddy yield at harvest. In some cases, the rice cultivars responded differently to herbicide rate(s) at the same and even at different sampling dates in both studies.

In the study, Ex-China exhibited higher injury than ITA257 when dimethametryne was applied at 1.50 to 2.50kgai\ha in the screen house and at 1.50, 2.0 and 3.0 kgai\ha in the field. While, dimethametryne at 2.50 and 3.0kgai\ha resulted in similar injury when applied to ITA

257, the same herbicide at 3.0kgai\ha caused significantly higher injury and lower vigour than 2.50kgai\ha on Ex-china in the field. The susceptibility of Ex-china can be attributed to its (Ex-china) inability to effectively convert the herbicide into harmless metabolites. This is because tolerance of rice plants to dimethametryne is based on the ability of rice plants to convert the herbicide to harmless metabolites which conjugates with the rice plants constituents (Akobundu,1987).

Crop vigour was observed to be significantly lower when dimethametryne was applied at 4.0kgai\ha compared with the same herbicide at 3.50kgai\ha on ITA 257 and at 4.0kgai\ha compared with 2.50 to 3.50kgai\ha on Ex-china at 6 to 10WAS in both studies. It was commonly reported that herbicide phytotoxicity in crops increases with increasing rates (Anderson, 1977; Noriel and Mercado,1981; Oosterhuis *et al* 1990).

Although, significant interaction between rates of dimethametryne and rice cultivars on height of plants was noted, differential response among rice cultivars to rates of dimethametryne was observed in both the screen house and field. Similar observation have been reported by Colon and Amarale (1985), Oosterhuis *et al* (1990) Shin *et al* (1992).

In the screen house, Ex-china produced significantly lower LA\plant than ITA257 at herbicide rates 2.0 and 2.50kgai\ha at 8 and 12WAS. Also, the application of dimethametryne at 2.50kgai\ha resulted in significantly lower LA\plant than at 2.0 on ITA257. Similarly, in the field, Ex-china produced significantly lower LA\plant with dimethametryne at 3.0 and 4.0kgai\ha at 4 and 8WAS. The rice cultivars tolerated dimethametryne in both the field and in the screen house which may be attributed to a number of exogenous factors some of which may be less prevalent in the screen house and vice versa.

The application of dimethametryne at 1.0 to 2.0kgai\ha on Ex-china resulted in significant higher tiller than on ITA257 in the screen house. The observed higher tiller number at these herbicide rates may not be soley herbicidal effect but genetic as well since Ex-China is known to be high tillering in character (Anon,1985). Plants of Ex-china produced significantly lower shoot dry matter than ITA 257 with the application of dimethametryne at 2.50 and 3.0kgai\ha. The differences in shoot dry matter between the two cultivars at these herbicide rates can be attributed to differential susceptibility of the cultivars at these rates.

5.4. CORRELATION COEFFICIENT.

The significant positive correlation of paddy yield with parameters such as crop vigour, plant height, LA\plant, tiller number and shoot dry matter is an indication that these parameters are important determinants of paddy yield. The negative relationship observed between the paddy yield and crop injury indicates that herbicide and the rate of application is\are not properly selected. Similar significant positive and negative correlation of shoot dry matter with parameters mentioned above were also observed in the screen house study.

Positive correlation of paddy yield with crop vigour LA\plant and tiller number was reported by Anon (1973) and Abubakar (1991). Some other workers have reported negative correlation between paddy yield and crop injury as a result of herbicide application (Snipes et al, 1984, Zhang, 1989; Pablico and Moody, 1991).

CHAPTER 6

6.0 SUMMARY AND CONCLUSION

Both the screen house and field trials were conducted at Samaru - Zaria in the Northern Guinea Savanna of Nigeria, to study the differential tolerance of two selected rice (*Oryza Sativa* L.) cultivars (ITA 257 and Ex-china) to various rates of dimethametryne (herbicide). Dimethametryne (herbicide) was evaluated at 0.25; 0.5; 1.0; 1.5; 2.0; 2.5; 3.0; 3.5 and 4.0kg ai/ha.

The results obtained indicated that low to near medium rates of dimethametryne (0.25 - 1.00kg ai/ha) were well tolerated by both cultivars while higher rates (3.0 - 4.0kg ai/ha) were phytotoxic to the cultivars resulting in severe crop injury, poor crop vigour, reduced LA/Plant and low shoot dry weight and paddy yield compared to untreated control in both trials. In the screen house, herbicide at 3.0 to 4.0kg ai/ha resulted in total crop loss.

Rice cultivars responded differentially to the various herbicide rates particularly at medium to higher rates (2.0 - 4.0kg ai/ha) in the field trial. Ex-china was observed to be more susceptible while ITA 257 was found to be more tolerant to the herbicide rates resulting in its (ITA 257) least injury, better growth vigour, higher LA/Plant, shoot dry weight and paddy yield. Shoot dry weight at 12WAS in the screen house and paddy yield in the field correlated negatively with herbicide injury while these positively

correlated with all other parameters. No correlation was observed between shoot dry weight, paddy yield and crop emergence in both trials.

In conclusion, results obtained from these trials suggest that:

1) Dimethametryne at rates ranging from 0.25 - 1.0kg ai/ha were well tolerated while higher rates 3.0 - 4.0kg ai/ha were phytotoxic to the rice cultivars.
2) Rice cultivar ITA 257 exhibited better tolerance to the herbicide rates than Ex-china.

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BIOGRAPHY

NAME: ADEKPE, David Idoko

DATE OF BIRTH: 25th September, 1965

PLACE OF BIRTH: Ohuma Adum-East, Ito

L.G.A. AND STATE ORIGIN: Obi, LGA, Benue State

PERMANENT HOME ADDRESS: Methodist Church, Ohuma, Adum-East, Ito

INSTITUTIONS ATTENDED WITH DATES

	Period Obtained		Certificate
	From	To	
L.E.A. Primary School Adum-East, Ito	1970	1976	FSLC
Govt. College Kaduna	1976	1981	G.C.E. O'L
School of Basic Studies Makurdi	1982	1984	I.J.M.B
Ahmadu Bello University, Zaria	1986	1990	B.Agric.

WORKING EXPERIENCE	Period		Postheld
	From	To	
N.Y.S.C. SARDA, Sokoto	1990	1991	Evaluation and Monitoring Officer
Mt. St. Michael's Aliade	1992		Tutor
Institute for Agricultural Research, Ahmadu Bello University, Zaria	1995	to Date	Research Fellow
Year of Admission for Post-graduate Studies	1994		
Admission Number	M.Sc/Agric/05332/1993-94.		