STRIGA RESEARCH ACTIVITIES IN CENTRAL, EASTREN, LAKE AND SOUTHERN HIGHLAND ZONES OF TANZANIA: ON STATION AND ON-FARM TRIALS FOR 2001/2002

Released variety Wahi

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Preface

Striga species principally attack and reduce the yields of finger millet, maize, sorghum and upland rice in these regions. In many areas it is the crops of resource poor farmers, which are affected by the weeds. They impose an additional stress with which people, who have little capacity for investment crop production, have to cope in an environment characterized by marginal rainfall for cropping and declining soil fertility. Since 1996 scientists from the Department of Research and Development, and Sokoine University of Agriculture in Tanzania and Natural Resource Institute and University of Sheffield in the UK have been collaborating in studies aimed at developing integrated Striga control options. Studies were being undertaken both on-station and on Striga infested farmers fields in the Central, Eastern, Lake and Southern Highlands zones of Tanzania, with laboratory work at Sheffield University in UK. The on-farm work was done in collaboration with extension staff. The work emphasized on:

Farmer assessment of Striga tolerant/resistant varieties

The testing of developed learning tools for greater understanding of Striga biology and control

Understanding the differential performance of sorghum cultivars under a range of levels of soil fertility

Farmers assessment of cultural practices which reduce the impact of Striga in upland rice.

Working papers are being produced with the aim of providing preliminary results in order to encourage discussion and shape further activities. The following papers summarizing previous results are obtainable from

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Multi-location Evaluation of Striga resistance promising Sorghum cultivars 2002:

Materials and methods:

Six sorghum cultivars including P9405, P9406, SRN 39, Macia, Weijita and Pato were evaluated for Striga resistance on –station at four locations for the season 2002. The locations included Melela a hot spot for S. asiatica and S. forbesii, Hombolo a hot spot for S. asiatica, Ukiriguru for S. hermonthica and at a Striga free plots Ilonga. Plots size were four rows of 5m long, inter row spacing 0.75m and intra row spacing 0.15m. Striga was counted from the two middle rows at 9 and 12weeks after planting and at harvest. The sorghum grain yield was also obtained from the same two middle rows. The main aim was to determine the performance of the two Striga resistant sorghum cultivars P9405 and P9406 as compared to susceptible cultivar Pato

Results

Melela site: Sorghum variety Hakika supported relative Striga numbers than the susceptible check Pato. From Wahi (P9406) plots the parasite emerged at 12 WAP for both Striga species *S. asiatica* and *S. forbesii* and were much less in numbers compared from the plots of the susceptible check Pato. From sorghum grain yield Hakika produced higher grain yield than Pato but Wahi produced less grain yield 1.2t/ha while Pato produced 1.5 t/ha. (Table 1.1)

Hombolo site: Compared to Pato, sorghum variety Hakika (P9405) and Wahi (P9406) supported much less above ground emerged Striga numbers than Pato and highest grain yield was obtained from Hakika (P9405) (2.0t/ha) followed by Wahi (P9406) (1.6t/ha). Pato produced the least 0.9t/ha (Table1.2).

Ukiriguru site: The data recorded this season contradicted those obtained from previous years, Pato supported less Striga numbers than Hakika (P9405) and Wahi (P9406). It looks an error had occurred during data recording. Surprising Hakika and Wahi produced higher grain yield than Pato, which had the lowest Striga count (Table1.3).

Ilonga site (Striga free plots): Pato as for previous years it produced higher grain yield than Hakika (P9405) and Wahi (P9406) It produced 3.7t/ha while each of the varieties Hakika and Wahi produced 3.2t/ha. The highest sorghum grain yield was obtained from Macia 4.0t/ha (Table 1.4)

On disease scores only sooty stripe symptoms were observed and there was no difference in scores between Pato and from both Hakika and Wahi (Table 2.8).

Dodoma rural District 2002

1.Mvumi Makulu village

The performance of sorghum varieties Hakika (P9405) and Wahi (P9406) is shown in Table (2.1), where the two cultivars supported low Striga numbers and Pato had the highest number of Striga counts at both counting dates 12WAP and at harvest.

The highest grain yield was obtained from Hakika (2.0t/ha) followed by Wahi (1.4t/ha) and Pato produced the least only 0.8t/ha

2. Mpalanga village:
Sorghum genotype Hakika (P9405) and Wahi (P9406) recorded lower Striga numbers at both 12WAP and at harvest than the sorghum variety Pato. The check Pato had the highest number of Striga counts (Table 2.2). The performance of the varieties on grain yield was relative low due to effect of armyworm attack and draught at early growth stage the crop and at flowering stages respectively. Hakika (P9405) produced 824kg/ha and Wahi 800kg/ha as compared to Pato, which produced 760kg/ha.

3. Chipanga
At Chipanga village there was a lot of rain this season, which resulted to no Striga emergence. Striga does not germinate under wet conditions. As shown in Table 2.4, 2.5 sorghum varieties Hakika and Wahi produced grain yield lower than Pato. Hakika produced 1.0t/ha and Wahi 1.2t/ha while Pato produced 1.4t/ha.

<u>Missungwi District 2002</u>:
1.Mwagalla village:
Lowest Striga numbers were observed from Hakika (P9405) and Wahi (P9406) at the three stages of Striga counts 9WAP, 12WAP and at harvest and sorghum variety Pato showed relative the highest, but the counts were below 90 Striga counts/25$m^{2.}$ In terms of grain Hakika and Wahi produced each 1.2t/ha while Pato 1.1t/ha (Table 2.7)

2. Iteja village:
The Striga numbers recorded from sorghum varieties Hakika and Wahi were less than those recorded on Pato at all stages of Striga counts and the difference was statistically significant. Due to midge attack at flowering stage the grain yield of the varieties was severely affected by the pest. From the yield data obtained variety Hakika produced 603kg/ha and Wahi 783 kg/ha, while the check variety Pato produced only 337kg/ha (Table 2.6).

Conclusion:
Sorghum Variety Hakika (P9405) generally supported the least Striga numbers at all trial sites.
Under Striga infested fields, Hakika (P9405) produced relative higher grain yield than the released sorghum variety Pato but when these cultivars were grown under Striga free fields, Pato out yielded the sorghum variety Hakika.
Sorghum variety Hakika (P9405) is recommended for fields highly infested with Striga, where Pato performs poorly.
High Striga tolerance was observed from the sorghum genotype Wahi (P9406). Under Striga infested fields both on station and on-farm Wahi (P9406) out yielded the released Striga susceptible sorghum variety Pato.
On Striga free fields the sorghum genotype Wahi (P9406) produced comparable lower grain yield than variety Pato.
This suggests that Wahi (P9406) can also be grown on Striga infested fields, where Pato is likely to perform poorly in terms of grain yield.

Evaluation of Advanced Sorghum cultivars for Striga Resistance, 2002
Sorghum materials comprising of Striga resistant, local checks and selections from crosses made by SADC/ICRISAT were evaluated for *Striga asiatica* and *S. forbesii* at Melela and for *S. hermonthica* at Ukiriguru sites. In total were 13 entries plated at each entry 4 rows of 5m long, replicated three times. Spacing between rows was

0.75m and intra spacing was 0.15m single plant per hill. Striga counts were done as described in the above trials.

Results and discussion
Results are shown in Table 1.5. Besides P9405 and P9406, crosses Macia x SAR 37, SAR 19 x NL 829, SV-2 x SAR 29, SAR 33x SV 2, and SAR 35 x SV-1 supported the fewest Striga compared to Pato but performed poorly in terms of grain yield

Evaluation of Striga resistant sorghum genotypes in combination with animal manure levels

Materials and Methods:
Sorghum cultivars P9405 and P9406, obtained from Purdue University in the USA, Pato and Macia commercially released varieties in Tanzania, were evaluated in combination with animal manure for *Striga asiatica* resistance at Hombolo Central Tanzania. The entries were planted in plots of four rows replicated four times. The treatments included ¼ kg and ½ kg animal manure per hill, 50 kg N/ha (Urea) and plots without fertilizer as control. The application of animal manure and urea was done at seed sowing. Striga counts were determined from two middle rows and counted at 9^{th} and 12^{th} Week after planting and at harvest. Sorghum grain yield was similarly assessed from the two middle rows. Data was analysed using ANOVA

Results and Discussion:
The sorghum entries P9405 followed by P9406 which were bred for *S. asiatica* resistance supported the least Striga numbers at all stages of Striga counts compared to the susceptible released sorghum variety Pato (Table 2.0). Pato had the highest Striga numbers at all stages of Striga count. The recently released variety Macia had lower Striga numbers than Pato but higher than that from P9405 and P9406 at all stages of Striga counting. The grain yield was highest from P9406 (2.1t/ha) and Macia (2.1t/ha), indicating Macia to have some tolerance to *Striga asiatica*, followed by P9405 (1.9t/ha). The lowest grain yield was obtained from Pato (1.6t/ha).

Table 1.1. Evaluation of sorghum cultivars for Striga resistance Melela – Morogoro rural 2002:

Sorghum entries	Plant count/7.5 m^2	Striga count/7.5m^2				yield (t/ha)
		9WAP		12WAP		
		S. asiatica	*S. forbesii*	*S. asiatica*	*S. forbesii*	
P9405	**64**	**0.3**	**0.0**	**0.5**	**0.0**	**1.9**
P9406	**65**	**0.0**	**0.0**	**0.5**	**0.3**	**1.2**
SRN 39	64	0.0	1.3	1.0	0.8	2.5
Weijita	66	2.3	13.5	67.3	40.8	0.9
Pato	**65**	**17.0**	**2.5**	**75.0**	**4.8**	**1.5**
Macia	65	0.0	1.0	24.0	10.3	1.3
Mean	64.8	3.25	3.04	24.71	9.46	1.53
S.E.	0.5	2.78	2.26	14.01	6.26	0.20

WAP = Weeks after planting

Table1.2: Evaluation of sorghum cultivars for Striga asiatica resistance, Hombolo 2002:

Sorghum entries	Plant stand	STRIGA COUNT			Plant height(cm)	Yield (t/ha)
		9WAP	12WAP	At harvest		
P9405	**78**	**17**	**18**	**25**	**106**	**2.0**
P9406	**90**	**14**	**23**	**41**	**95**	**1.6**
SRN 39	90	38	150	169	141	0.8
Weijita	93	23	125	141	171	0.7
Pato	**88**	**28**	**93**	**105**	**137**	**0.9**
Macia	90	12	58	71	108	1.1
Mean	**88.4**	**22.0**	**77.8**	**92.0**	**126.3**	**1.20**
S.E.	**2.7**	**3.6**	**14.8**	**15.2**	**5.9**	**0.15**

Table 1.3

Evaluation of sorghum cultivars for Striga hermonthica resistance, Ukiriguru, 2002:

Sorghum entries	Plant stand	STRIGA COUNT			Days to 50% flower	Leaf blight score(1-5)	Yield (kg/ha)
		9WAP	12WAP	At harvest			
P9405	**76**	**0.0**	**4.7**	**47.3**	**67**	**1.0**	**933**
P9406	**72**	**1.0**	**5.5**	**14.0**	**66**	**1.0**	**943**
SRN 39	66	0.0	7.3	48.0	80	1.3	890
Weijita	72	0.3	2.3	19.5	83	1.3	953
Pato	**67**	**0.0**	**3.5**	**9.0**	**84**	**1.5**	**823**
Macia	69	0.8	8.3	35.0	75	1.0	963
G. Mean	70.0	0.35	5.26	28.45	76.2	1.17	917
S.E.	1.3	0.18	1.09	7.60	1.8	0.08	55.3

Table 1.4. Evaluation of sorghum cultivars for Striga resistance, Ilonga 2002 (planted at Striga free plots).

Sorghum entries	Plant stand /7.5m^2	Days to 50% flower	Days to maturity	% lodged plants	Plant height (cm)	Sooty stripe score(1-5)	Yield (t/ha)
P9405	**57**	**52**	**80**	**1.0**	**165**	**2.0**	**3.2ab**
P9406	**56**	**57**	**85**	**0.0**	**150**	**2.0**	**3.2ab**
SRN 39	54	59	87	11.5	192	1.5	3.9bc
Weijita	53	63	92	22.5	309	2.8	2.7a
Pato	**46**	**63**	**91**	**17.0**	**247**	**2.0**	**3.7bc**
Macia	53	63	91	0.3	168	2.0	4.0c
Mean	53.0	59.4	87.5	8.63	205.0	2.04	3.40
S.E.	1.5	0.8	0.9	2.05	12.28	0.10	0.11

Means followed by different letters are statistically different from each other ($p \leq 0.05$) according to Duncan New Multiple Range test

Table1.5: Evaluation of Advanced Sorghum cultivars for Striga Resistance, Melela 2002

Entry	Stand count	9 WAP Striga count/7.5m^2		12 WAP Striga count/7.5 m^2		Yield (t/ha)
		S.asiatica	S. forbesii	S. asiatica	S. forbesii	
P 9403	44	5.0	0.3	0.3	1.7	1.0
P 9405	**63**	**3.7**	**0.7**	**0.3**	**0.7**	**1.0**
P 9406	**49**	**2.7**	**1.0**	**1.0**	**1.3**	**1.3**
SRN 39	42	2.0	21.3	2.3	23.0	1.3
Pato	47	6.8	16.7	31.3	65.0	1.2
Macia	37	1.3	18.7	3.3	36.7	0.9
Weijita	56	0.7	8.3	1.7	30.0	1.3
Weijita x Pato	56	4.0	9.3	4.0	10.7	0.8
Macia x SAR 37	**61**	**1.0**	**1.3**	**1.0**	**0.0**	1.1
SAR 19 x NL 829	**56**	**0.7**	**0.0**	**1.0**	**1.0**	1.1
SV-2 x SAR 29	53	0.0	0.0	0.0	0.3	0.8
SAR 33x SV 2	54	0.0	0.3	0.3	1.3	0.2
SAR 35 x SV 1	49	0.3	0.0	1.0	0.0	0.7
Mean	**51.1**	**2.15**	**6.00**	**3.67**	**13.21**	**0.97**
SE	**1.9**	**0.6**	**2.3**	**2.4**	**5.3**	**0.1**

WAP = Weeks after planting

Table 2.0: Effect of manure levels on number of emerged Striga and grain yield at Hombolo

Sorghum variety	**STRIGA COUNT**								**Grain yields (t/ha)**			
	P9405		**P9406**		**Macia**		**Pato**					
Fertilizer levels (Animal manure/urea)	**9WAP**	**12WAP**	**9WAP**	**12WAP**	**9WAP**	**12WAP**	**9WAP**	**12WAP**	**P9405**	**P9406**	**Macia**	**Pato**
0	1.8	4.8	3.7	6.8	5.5	13.9	7.7	15.6	1.8	1.7	1.2	1.0
¼ kg/hill	2.0	3.4	3.7	6.9	5.4	8.6	6.3	13.3	2.0	2.1	**1.9**	**2.6**
½ kg/hill	**1.1**	**1.4**	**1.9**	**4.3**	3.5	5.8	3.9	6.8	**2.1**	**2.1**	1.6	2.5
50 kg/ha (urea	1.6	3.1	1.9	4.5	**2.3**	**5.0**	**3.8**	**3.7**	1.8	1.9	1.5	1.1

Table 2.1:On-farm evaluation of promising sorghum genotypes for *Striga asiatica* resistance and grain yield, at Isang'a Chitope soils, Mvumi Dodoma rural 2002:

Sorghum entries	Plant count/25m2	STRIGA COUNT/25m2		Grain yield t/ha
		12WAP	At harvest	
P9405	**116**	**18.0**	**143.7**	**2.0b**
P9406	**125**	**13.7**	**20.5**	**1.4ab**
Macia	128	265.3	276.8	1.1ab
Pato	**134**	**301.0**	**776.8**	**0.8a**
G.Mean	**125.6**	**149.50**	**304.46**	**1.31**
S.E.	**11.4**	**68.41**	**163.88**	**0.96**

Table 2.2:.On-farm evaluation of sorghum genotypes for *Striga asiatica* resistance and grain yield, Mpalanga village – Dodoma rural 2002

Sorghum Entry	Plant stand count	STRIGA COUNT/25m^2			Grain yield kg/ha
		9WAP	12WAP	At harvest	
Pato	**75**	**-**	**18.2**	**135.4b**	**760**
P9406	**86**	**-**	**7.8**	**39.4a**	**800**
P9405	**72**	**-**	**5.8**	**41.8a**	**824**
Macia	82	-	13.2	140.6b	850
G. Mean	78.1	-	11.25	89.30	806.0
S.E.	8.3	-	5.73	16.30	100.0

2.3:On-farm evaluation of promising sorghum genotypes for *Striga asiatica* resistance and grain yield, Chipanga 2002:

Sorghum entries	**Plant count/25m^2**	**STRIGA COUNT/25m2**			**Grain yield kg/ha**
		9WAP	**12WAP**	**At harvest**	
P9405	**72**	**0**	**5,8**	**41.8**	**824**
P9406	**86**	**0**	**7.8**	**39.4**	**800**
Macia	83	0	13.2	140.6	850
Pato	71	0	18.2	135.4	760
G.Mean	**76.1**	**0.0**	**11.3**	**89.30**	**806.0**
S.E.	**8.3**	**0.0**	**5.7**	**16.30**	**0.1**

Table 2.4: On-farm evaluation of promising sorghum genotypes for *Striga asiatica* resistance and grain yield, at Nkuluhi soils, Chipanga village- Dodoma rural 2002:

Sorghum entries	**Plant count/25m^2**	**STRIGA COUNT/25m2**			**Grain yield t/ha**
		9WAP	**12WAP**	**At harvest**	
P9405	**153**	**0**	**0**	**0**	**3.4**
P9406	**117**	**0**	**0**	**0**	**2.8**
Macia	142	0	0	0	4.0
Pato	144	0	0	0	3.4
G.Mean	**139.3**	**0**	**0**	**0**	**3.40**
S.E.	**5.8**				**0.17**

Table 2.5: On-farm evaluation of promising sorghum genotypes for *Striga asiatica* resistance and grain yield, at Ngongomba soils, Chipanga village- Dodoma rural 2002:

Sorghum entries	**Plant count/25m^2**	**STRIGA COUNT/25m2**			**Grain yield t/ha**
		9WAP	**12WAP**	**At harvest**	
P9405	**98**	**0**	**0**	**0**	**1.0**
P9406	**104**	**0**	**0**	**0**	**1.4**
Macia	111	0	0	0	1.6
Pato	88	0	0	1.4	1.4
G.Mean	**100.3**	**0**	**0**	**1.03**	**1.34**
S.E.	**6.0**	**0**	**-**	**-**	**0.16**

Table 2.6: On-farm evaluation of promising sorghum genotypes for *Striga hermonthica* resistance and grain yield, at Luseni soils, Iteja village 2002:

Sorghum entries	**Plant count/25m^2**	**STRIGA COUNT/25m2**			**Grain yield t/ha**
		9WAP	**12WAP**	**At harvest**	
P9405	**44**	**3.8**	**11.2**	**14.2**	**1.2**
P9406	**43**	**6.2**	**18.6**	**24.4**	**1.2**
Macia	42	5.8	15.0	19.8	0.8
Pato	**45**	**9.4**	**45.4**	**89.8**	**1.1**
G.Mean	**43.4**	**6.30**	**22.55**	**37.05**	**1.06**
S.E.	**3.4**	**1.52**	**6.43**	**15.54**	**0.12**

Table 2.7: On-farm evaluation of sorghum genotypes for *Striga hermonthic*a resistance and grain yield, Mwagalla 2002

Sorghum Entry	Plant stand count	STRIGA COUNT/25m^2			Grain yield kg/ha
		9WAP	12WAP	At harvest	
Pato	128	35.8	196.0b	192.0b	337
P9406	**100**	**5.2**	**16.7a**	**27.3a**	**783**
P9405	**97**	**11.5**	**36.8ab**	**56.8a**	**603**
Macia	73	5.3	69.7ab	69.8a	437
G. Mean	99.6	14.46	79.79	86.50	540.0
S.E.	10.8	5.27	29.94	23.19	124.0

Table 2.8:
Disease score (scale 1-5) from sorghum cultivars tested on farm Dodoma rural 2002:

Sorghum entries	Leaf blight	Sooty stripe	Long smut
P9405	**1.5**	**1.4**	**1.4**
P9406	**1.5**	**1.3**	**1.8**
Macia	1.5	1.6	1.5
Pato	3.0	1.0	1.6
G.Mean	1.83	1.31	1.57
S.E.	0.12	0.07	0.14

Table: 3.1 Screening Rice germplasm for Striga asiatica in Kyela district Kilasilo village 2002

Entry	Stand count	Striga count 9WAP	Striga count 12WAP	Striga count at harvest
WAB 928-22-1-2-1B	35	2.5ab	7.5	1.5
WAB928-22-2-A-A-B	36	3.0ab	6.0	2.5
9928-22-1-1-B	38	1.5a	9.0	5.0
935-5-1-1-B	35	3.0ab	7.5	3.5
935-5-1-2-1-8	34	4.5b	9.0	4.5
935-2-1-1-B	38	2.5ab	8.5	4.0
Mean	**35.9**	**2.83**	**7.92**	**3.5**
S.E.	**1.1**	**0.34**	**0.54**	**0.66**

Table; 3.2 Screening Rice germplasm for Striga asiatica in Kyela district Itope village 2002

Entry	Stand count	Striga count 9WAP	Striga count 12WAP	Striga count at harvest
WAB 928-22-1-2-1-B	58	1.0	1.5	0.5
WAB928-22-2-A-A-B	64	1.0	3.5	1.0
9928-22-1-1-B	64	1.0	3.0	1.0
935-5-1-1-B	61	1.0	2.0	1.0
935-5-1-2-1-B	56	0.0	1.0	0.5
935-5-2-1-1-B	60	1.0	2.0	1.0