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Release of cowpea line IT99K-494-6 for yield and resistance to the parasitic weed, *Alectra vogelii* Benth. in Malawi

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Field trials were conducted between 2008/09 and 2009/10 seasons to evaluate four new cowpea lines, selected in preliminary studies, for yield, adaptation and resistance to the parasitic weed *Alectra vogelii* in Malawi. The design was randomised complete block design with 4 replicates at research stations and 5 at on-farm sites. For on-farm, villages were the sites and each farmer hosted one replicate. The trial sites were Lisasadzi, Mngwangwa, Bunda College, Chitedze Research Station, Rivirivi and Mpokwa in 2008/09 season and in 2009/10 the sites at Chitedze and Mpokwa were replaced by Mkwinda and Chitala Research Station. Four promising cowpea lines, IT98K-503-1, IT97K-825-15, IT99K-7-21-2-2-1 and IT99K-494-6, all originally from IITA and selected for resistance to parasitic weed *Alectra vogelii* in screen house studies, were compared with released varieties Sudan 1, IT82E-16 and a farmers local entry. The following parameters were evaluated: cowpea grain yield, plants/m^2, seeds/pod, seed weight (g/100 seeds), days to mid-flower, days to maturity, disease scores (scale 1 [clean] – 9 [most severe]) and *A. vogelii* emergence (plants/m^2). The line IT99K-494-6 was found to have comparable or better agronomic traits as compared to control varieties and was eventually released in Malawi in January 2011. The line which is medium maturing has brown grain texture with yield potential of 1-2.0 t/ha. Such a resistant variety is important in *A. vogelii* hot spots to reduce build up in soil seed bank and a viable option for farmers to rotate with cowpeas in order to manage other pests such as *Striga asiatica*, an important parasitic weed, or improve soil fertility through the nitrogen fixation of cowpeas.

Key words: Legumes, witchweeds, parasitic weeds, cowpea, *Alectra vogelii, Vigna unguiculata.*

INTRODUCTION

Cowpea is amongst the important food legumes in Malawi as it is drought tolerant and can do well in warm areas where beans cannot. In 2009/10 growing season, the yields of cowpeas under smallholder farmers in Malawi averaged 378 kg/ha from an area of 61,082 ha (MoAIWD, 2012). Cowpeas are an important source of

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Table 1. Test sites, global positioning systems (GPS) and elevation in 2008/09 and '09/10 seasons.

Site	Season	GPS	Masl	On-farm or station	AE$^+$ Zone
Bunda	2008/09; 2009/10	S14°11.096′; E33°46.340′	1194	Station	Mid
Mkwinda	2009/10	S 14°9.066′; E 33°47.312′	1153	Farm	Mid
Lisasadzi	2008/09; 2009/10	S13°15.587′; E33°26.344′	1045	Farm	Mid
Mngwangwa	2008/09; 2009/10	S14°53.284′; E3°42.194′	1133	Farm	Mid
Chitedze	2008/09	S14°0.246′; E33°38.993′	1145	Station	Mid
Mpokwa	2008/09	S15°01.761′; E34° 56.386′	939	Farm	Low
Rivirivi	2008/09; 2009/10	S15°02.704′; E34°54.145′	649	Farm	Low
Chitala	2009/10	S13°41.206′; 34°14.606′	643	Station	Low

AE$^+$ = Agro-Ecological; Masl = meter above sea level.

protein averaging 22 - 34% (Elias et al., 1964; Neil and Brits, 1992; Mahe et al., 1994) and cash for smallholder farmers. The main constraints to its production are insect pests, diseases and lack of suitable varieties (MoAFS, 2005). In 2009/10 growing season, most farmers planted improved cultivar Sudan 1, variety IT82E-16 and local seeds which are preserved and recycled. Potential yields of cowpea is 2,000 kg/ha (MoAFS, 2005). However, *Alectra vogelii*, a parasitic weed for legumes, is also of growing concern particularly as legumes have been widely promoted for some time (ICRISAT/MAI, 2000; Ngwira et al., 2012). The Malawi Government, through the Farm Input Subsidy Program (FISP) also promotes legumes (MoAIFS, 2007). The weed *A. vogelii* is widely seen in Lilongwe and Kasungu plains and many parts of southern region (Riches and Shaxson, 1993; Kabambe et al., 2005; Mainjeni, 1999; Kabambe et al., 2008a, b). In Tanzania yield losses of up to 50% have been reported (Mbwaga et al., 2000). In Kenya, Bagnall-Oakley et al. (1991) reported total crop loss in some parts. In Botswana, Riches (1989) reported losses of 80 - 100% in a susceptible cultivar. Yield losses of up to 15% have been reported in groundnut in Nigeria (Salako, 1984), while in South Africa 30 - 50% reductions in yield of bambara were reported (Beck, 1987). In northern Nigeria, Lagoke (1989) reported that late-sown crops of soybean may be completely destroyed by the parasite. The witchweed *A. vogelii* may be controlled through trap crops such as dolichos bean (*Lablab purpureus* [L.] Sweet) cotton (*Gossypium hirsutum* L.), okra (*Hibiscus esculentus* L.), sunflower (*Helianthus annuus* L.) pea (*Pisum sativum* L.) and faba bean (*Vicia faba* L.) (Parker and Riches, 1993). There is generally greater availability of resistant genotypes against *A. vogelii* (Riches, 2001; Mainjeni, 1999; Rubiales et al., 2006; Omoigui, 2012). Thus, production is threatened by *A. vogelii* and screening for resistance among existing legumes crops or varieties can help to avoid working with the most susceptible varieties. The parasitic weed *Striga asiatica* is also a serious problem in Malawi (Kabambe et al., 2002, 2005), such that the introduction of legume varieties with resistance *to A. vogelii* would be useful to encourage farmers to adopt legumes as trap crops for it or soil fertility replenishment. Also, resistant varieties would slow down the seed build-up of the pest in soils. This study was therefore conducted to evaluate some selected cowpea lines for yield adaptability and resistance to the parasitic weed *A. vogelii*.

METHODOLOGY

Trials design, sites, test materials and management

Four cowpea lines, IT98K-503-1, IT97K-825-15, IT99K-7-21-2-2-1 and IT99K-494-6 were evaluated for yield and resistance to the parasitic weed species *A. vogelii* under field conditions in 2008/09 and 2009/10 in Malawi. These lines were ex-IITA (International Institute of Tropical Agriculture) and were selected for evaluation based on earlier screen house screening for resistance to *A. vogelii* and preliminary yield trials. The lines were compared to released varieties Sudan 1, IT82E-16 and farmers local entry. In both seasons, there were four mid-altitude sites and two low altitude sites. The names, geographic position and altitude of the sites are given in Table 1. The trial design was randomized complete block with four replications at station sites while on-farm there were five replicates, with one farmer hosting one replicate.

Experimental plots had 5 with ridges each 4 m long and 0.75 m apart (gross plot size 15 m^2). No fertilizers were applied to plots. Two seeds of cowpeas were planted at 20 cm apart. Planting was done with first rains in low altitude sites and in mid-January for mid-altitude sites according to standard recommendations (MoAIFS, 2005). There were 4-5 farmers per village or site, making one complete trial.

Data collection and analysis

All crop plant or *A. vogelii* data was collected from the three middle rows (net plot size 12 m^2). Data were collected for evaluation of plant cowpea grain yield (adjusted to 12.0% moisture), plant count/m^2, *A. vogelii* counts/m^2, seed weight, seeds/pod, pod length (cm) days mid-flower and maturity. Counts of *A. vogelii* were taken at time of flowering of cowpeas. Assessment for disease was done at Chitedze Research Station only, where the project pathologist is based. Entries were scored for *Aschochyta* blight (*Ascochyta phaseolorum*), Scab (*Elsinoe phaseoli*) and *Cercospora* leaf spot infection. Disease scores were based on 1-9 scale where 1 was clean and 9 was severe. For infection, the score was the percentage of plants infected. Data were analyzed on site basis

Table 2. Mean monthly rainfall (mm) for the some trial sites in 2008/09 and '09/10 seasons.

Month	Site and season							
	Bunda		Mngwangwa		Rivirivi		Chitedze	Chitala
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
Oct. '09	18.5	0.9	0	0	3.0	16.5	45	0
Nov. '09	119.2	60.5	51	83	113.4	55.4	112	5
Dec. '09	177.1	114.5	147	184	242.1	113.5	116.4	88.1
Jan. '10	291.9	125.1	198	249.5	300.5	222.7	227.8	220.9
Feb. '10	174.0	337.6	152	306	145.1	320.9	121	476.5
Mar. '10	218.3	118.4	134	71	125.1	72.6	223.7	156.2
Apr. '10	28.0	5.4	71	36.5	6.3	34.6	18.1	0
May '10	0	4.7	0	0	0	0	0	0
Total	1026.7	767	753	930	932.5	836.2	864	946.7

Table 3. Effect of genotype on *Alectra* counts m^{-2} taken after flowering at all the trial sites in 2008/09 season.

Entry name	Bunda*	Lisasadzi	Mngwangwa	Mpokwa	Rivirivi	Chitedze
IT98K-503-1	1.35bc	0.50b	3.33	0.6	0.0	0.05
IT97K-825-15	0.08c	0.70b	0.60	0.03	0.08	0.25
IT99K-7-21-2-2-1	0.25c	1.38b	1.46	0.11	0.0	0.17
IT99K-494-6	0.00c	0.60b	1.02	0.04	0.03	0.0
Sudan-1	5.82a	3.56ab	4.03	0.86	0.0	0.58
IT82E-16	6.25a	6.70a	2.86	0.96	0.14	0.0
Farmers' local	2.80b	1.14b	3.29	-	0.03	0.11
Mean	2.36	2.08	2.43	0.44	0.04	0.17
F Prob	<0.001	0.005	0.13	0.28	0.32	0.29
LSD (0.05)	1.59	3.28	3.0	1.0	0.13	0.56

*Means in column denoted by same letter are not significantly different at 5% using LSD.

according to the analysis of variance procedure using the Genstat package. Comparisons between means was done using the least significant difference, LSD, t_{α} = 0.05.

RESULTS

Rainfall

In 2008/09 rainfall was normal and fairly distributed for all sites except Mngwangwa and Chitedze, which had relatively poorly rains in February 2009 (Table 2).

Alectra emergence

In 2008/09, the sites at Mngwangwa and Lisasadzi had high infestation of *Alectra*, even though yields were good (Table 3). However, within the plots, spots that had high numbers of *Alectra* caused stunted growth and wilting on cowpea plants. At Mngwangwa, where pressure was high, entries IT99K-7-21-2-2-1, IT97K-825-15 and IT99K-494-6 showed fair resistance. At Lisasadzi, with high *Alectra* pressure the same lines showed good resistance (low support of parasite). At Bunda College, with high *Alectra* pressure, the same three lines showed resistance. On the overall, entries IT99K-494-6 and IT99K-7-21-2-2-1 were best for resistance with maximum Alectra of 1.02 and 1.46 plants m^{-2}, respectively, as compared to maximum emergence of 6.7 and 5.82 plants m^{-2}, respectively for IT82E-16 and Sudan-1, the local checks.

In 2009/2010, entry IT99-494-6 was the most resistant line among the seven entries and was followed by IT97K-825-15 and IT99K-7-21-2-2-1, respectively (Table 4). On the overall, IT99K-494-6 and IT97K-825-15 were the best for resistance with 0.10 and 0.80 plants m^{-2} respectively, and entry IT99K-494-6 have nil *Alectra* at Mkwinda and only 0.04 plants m^{-2} at Lisasadzi. There was no Alectra emergence at Bunda College, Chitala and Riviri.

Grain yields

Tables 5 and 6 show cowpea grain yields from mid-altitude sites in 2008/09 and 2009/10. In 2008/09, the line

Table 4. Effect of genotype on *Alectra* counts m^{-2} taken after flowering at three sites in 2009/10.

Entry	Lisasadzi	Mngwangwa	Mkwinda
IT98K-503-1	2.27	2.5	1.9
IT97K-825-15	0.98	1.1	0.3
IT99K-7-21-2-2-1	0.35	3.5	0.1
IT99K-494-6	0.04	0.2	0
SUDAN-1	2.82	2.8	0.8
IT82E-16	2.04	11.9	0.7
Farmers local	2.80	18.0	1.1
Mean	1.61	5.7	0.7
F prob	0.44	0.06	0.18
LSD (0.05)	3.33	13.3	1.59

*Means in column denoted by same letter are not significantly different at 5% using LSD.

Table 5. Grain yield kg/ha of cowpea entries at mid-altitude trial sites in 2008/09.

Entry	Site			
	Lisasadzi	Mngwangwa	Bunda	Chitedze
IT98K-503-1	2034^{ab}	856	1496	1667^{b}
IT97K-825-15	1527^{b}	796	1276	1083^{b}
IT97K-7-21-2-2-1	1749^{b}	543	1665	1222^{b}
IT99K-494-6	2345^{a}	1114	1846	972^{b}
IT82E-16	1936^{ab}	903	1631	3194^{a}
SUDAN-1	2328^{a}	1070	1728	2278^{ab}
LOCAL	-	536	794	1861^{ab}
MEAN	1936	831	1492	1754
F PROB	<0.025	0.058	0.208	0.03
LSD (0.05)	523	435	830	1340

*Means in column denoted by same letter are not significantly different at 5% LSD.

Table 6. Grain yield (kg/ha) of cowpea entries at mid-altitude trial sites in 2009/10.

Entry	Site			
	Bunda	Lisasadzi	Mngwangwa	Mkwinda
IT98K-503-1	1808^{ab}	1421^{bc}	730^{c}	979^{b}
IT97K-825-15	1102^{d}	658^{f}	361^{e}	434^{d}
IT99K-7-21-2-2-1	1266^{d}	1024^{e}	619^{d}	763^{c}
IT99K-494-6	1528^{cd}	1757^{a}	932^{a}	1195^{ab}
Sudan1	1621^{bc}	1376^{cd}	938^{a}	1027^{ab}
IT82E-16	2076^{a}	1513^{b}	861^{a}	1060^{ab}
Farmers local	1019	1275de	528^{d}	1089^{ab}
Mean	1489	1289	710	935
P	<0.001	<0.001	<0.001	<0.001
LSD 5%	337	111	99	139

*Means in column denoted by same letter are not significantly different at 5% LSD.

IT99K-494-6 gave the highest yields at Lisasadzi, Bunda and Mngwangwa, which were sites with highest *Alectra* pressure. In 2009/2010, the line IT99K-494-6 gave highest or joint highest yields at Lisasadzi, Mngwangwa

Table 7. Grain yield kg/ha of cowpea entries at two low altitude trial sites in 2008/09 and 2009/10 seasons.

Entry name	Site and season		Site and season	
	2008/09		2009/10	
	Rivirivi	Mpokwa	Rivirivi	Chitala
IT98K-503-1	749[b]	461[b]	1165[b]	849
IT97K-825-15	589[b]	447[b]	1064[b]	693
IT97K-7-21-2-2-1	903[b]	353[b]	1328[b]	852
IT99K-494-6	1372[ab]	562[b]	1189[b]	786
IT82E-16	2156[a]	896[ab]	1255[b]	855
Sudan-1	2158[a]	1402[a]	2029[a]	980
Local	964[b]	353[b]	1814[ab]	852
Mean	1270	681	1406[b]	838
LSD	878	544	457	242
F Prob	0.004	0.004	0.002	0.38

*Means in column denoted by same letter are not significantly different at 5% LSD.

Table 8. Effect of genotype on days to 50% flower at 5 sites, 2008/09.

Entry	Mngwangwa	Bunda	Lisasadzi	Mpokwa	Balaka
IT98K-503-1	46[b]	52[b]	57[b]	46[b]	48
IT97K-825-15	47[b]	56[a]	58[b]	53[a]	52
IT97K-7-21-2-2-1	48[ab]	54[ab]	59[b]	53[a]	53
IT99K-494-6	46[b]	52[b]	57[b]	46[b]	47
52=IT82E-16	44[c]	48[c]	55[b]	39[c]	46
53=Sudan-1	46[b]	47[c]	59[b]	41[c]	51
54=Local	50[a]	53[a]	89[a]	-	52
Mean	47	52	62	46	50
P	<0.001	<0.001	<0.001	<0.001	0.80
LSD	2	3	6	3	12

and Mkwinda (Table 6). However, the two released varieties also gave similar high yields. In the low altitude sites Sudan 1 and IT82E-16 gave better yields than IT99K-494-6 (Table 7).

Days to mid-flower and maturity

The number of days to 50% flower in 2008/09 season is shown in Table 8. Plants flowered earliest at low altitude sites as compared to mid-altitude sites. The entry IT82E-16 was the earliest to flower at both mid and low-altitude sites (range 39-55 days, followed by Sudan 1 (range 41-59 days) then entries IT99K-494-6 and IT99K825-15 (range 49-57 days). In general, the maximum difference between flowering dates of the improved varieties was about 10 days. In 2009/10 the trend was similar in terms of variety responses. However, flowering was generally delayed by about 2 days (Table 9). The flowering time can vary depending on planting date which affects temperature exposure during the season. Discussions with farmers revealed that such differences were quite important to them.

The effects of variety on days to maturity are shown in Tables 10 and 11. In 2008/09, plants matured early at Rivirivi and Mpokwa (66 days as compared to the other sites (76-81 days), which was expected as these sites are climatically warmer and drier areas. The entry IT99K-494-6 matured between 71 and 82 days in the mid-altitude sites, as compared to 72-74 days for Sudan-1. In 2009/10 season, the entry IT99K-494-6 matured between 71 and74 days in the mid-altitude sites, as compared to 65 and 68 days for Sudan-1.

Disease incidence and scores

Assessment for disease was done at Chitedze Research Station only in 2008/09. Entries were evaluated for *Aschochyta* blight (*Ascochyta phaseolorum*), scab (*Elsinoe phaseoli*) and *Cercospora* leaf spot infection. The results showed no significant differences amongst

Table 9. Effect of genotype on days to 50% flower in 2009/10.

Entry	Mid altitude sites				Low altitude sites	
	Mngwangwa	Lisa Sadzi	Bunda	Mkwinda	Chitala	Rivirivi
IT98K-503-1	56d	52^{c}	55^{b}	56	50	53
IT97K-825-15	63^{c}	57^{b}	58^{a}	59	51	56
IT97K-7-21-2-2-1	58^{c}	56^{b}	57^{a}	56	49	48
IT99K-494-6	58^{a}	56^{a}	56^{a}	56	49	48
SUDAN 1	54^{d}	52^{c}	52^{c}	53	47	51
IT82E-16	55^{d}	51^{d}	53^{c}	44	48	50
LOCAL	60^{b}	51^{d}	57^{a}	61	48	50
MEAN	58	54	55	55	49	52
P	<0.001	<.001	<.001	0.39	0.10	0.002
LSD (0.05)	2	1	2	15	2.7	5.4

*Means in column denoted by same letter are not significantly different at 5% LSD.

Table 10. Effect of cowpea line on days to maturity in 2008/09 season.

Entry	Mid-altitude sites			low altitude sites	
	Mngwa Ngwa	Bunda	Lisasadzi	Mpokwa	Balaka
IT98K-503-1	79^{b}	82^{b}	73^{b}	64^{b}	61
IT97K-825-15	83^{a}	88^{a}	72^{b}	74^{a}	69
IT97K-7-21-2-2-1	80^{b}	83^{b}	76^{b}	73^{a}	70
IT99K-494-6	80^{b}	82^{b}	71^{b}	65^{b}	60
IT82E-16	74^{c}	75^{c}	60^{c}	59^{c}	66
SUDAN-1	74^{c}	74^{c}	68^{bc}	60^{c}	69
LOCAL	80^{b}	83^{b}	107^{a}	-	68
MEAN	78	81	76	66	66
P	<0.001	<0.001	<0.001	<0.001	0.57
LSD (0.05)	2	2	11	3	13.2

Table 11. Days to maturity of cowpea entries 2009/10.

Entry	Mid altitude sites				Low altitude sites	
	Bunda	Lisasadzi	Mngwangwa	Mkwinda	Rivirivi	Chitala
IT98K-503-1	71^{d}	68^{d}	71^{c}	71^{c}	62^{cd}	72
IT97K-825-15	79^{a}	79^{a}	89^{a}	80^{b}	68^{b}	71
IT97K-7-21-2-2-1	76^{b}	74^{b}	77^{b}	73^{c}	73^{a}	71
IT99K-494-6	74^{c}	71^{c}	73^{bc}	73^{c}	60^{d}	71
IT82E-16	67^{e}	64^{e}	65^{c}	65^{d}	62^{cd}	70
Sudan-1	67^{e}	65^{e}	68^{c}	66^{d}	61^{cd}	70
Local	70^{d}	67^{d}	73^{b}	89^{a}	65^{bc}	71
Mean	72	70	74	74	64	71
P	<0.001	<.001	<0.001	<.001	<.001	0.63
LSD (0.05)	2	3	5	3	5	2.4

entries for early or late evaluation (Table 12). The scores for *Aschochyta* blight showed medium levels at both early and late stages of assessment while scab scores were quite high at the late scoring stage, averaging 6.0, which are close to severe. The infection of *Cercospora* and scores were also high. The high yields of the released varieties reflect a high degree of tolerance and adaptability.

Table 12. Summary of analysis of variance for disease scores at Chitedze Research Station, 2008/09.

Disease and time of scoring	Mean	F Prob	CV (%)
Aschochyta blight early	2.5	0.43	24
Aschochyta blight late	3.4	0.6	21
Scab early	3.7	0.43	44
Scab late	5.9	0.09	19
Cercospora leafspot incidence (%) early	25	0.38	36
Cercospora leafspot incidence (%) late	71.2	0.80	23
Cercospora leafspot infection early	5.1	0.44	22
Cercospora leafspot infection late	6.7	0.14	11

Table 13. Trial means and standard deviation (in brackets) of yield components and other agronomic traits, 2009/10.

Entry	Plants m^{-2}	Pod length (cm)	Seed per pod	Seed weight g/100
IT98K-503-1	10.00 (2.47)	12.96 (1.04)	8.94 (0.90)	13.20 (0.27)
IT997K-825-15	10.07 (2.72)	13.72 (1.26)	10.66 (0.81)	11.69 (0.61)
IT97K-7-21-2-2-1	11.25 (2.35)	14.26 (0.74)	9.96 (0.94)	17.57 (0.34)
IT99K-494-6	10.07 (2.35)	13.08 (0.24)	9.82 (0.35)	12.92 (0.55)
IT82E-16	11.13 (4.38)	17.00 (0.55)	14.48 (0.94)	10.44 (1.00)
Sudan 1	11.47 (1.79)	16.16 (1.15)	13.72 (1.30)	9.84 (0.21)
Farmers local	10.67 (1.44)	16.72 (1.10)	13.94 (1.09)	13.03 (0.56)

Other agronomic traits, yield components and variety description

Trial means for other agronomic traits and yield components for 2009/10 season are shown in Table 13. All entries seemed to have similar plant establishment with a narrow range of 10-11.4 plants per m^2. The released varieties were generally superior on pod length and seeds per pod. The new lines were superior in terms of seed weights per pod.

DISCUSSION

The results are in agreement with other reports which show wide availability in resistant genotypes against *A. vogelii* (Mainjeni, 1999; Kabambe et al., 2008a, Mbwaga et al., 2000; Riches, 1989, 2001; Rubiales et al., 2006; Omoigui, 2012). The results also generally showed that *A. vogelii* is naturally more prevalent in the mid-altitude sites where all entries are better adapted. The nature of these studies did not allow the researchers to determine yield loss due to *A. vogelii* parasitism, however, it is clear that the two local checks IT82E-16 and Sudan 1 were tolerant to it, owing to their high yields although they supported high numbers of *A. vogelii*. In Botswana, Riches (1989) reported losses of 80 – 100% in a susceptible cowpea cultivar. In northern Nigeria, Lagoke (1989) reported that late-sown crops of soybean may be completely destroyed by the parasite. Although three of the new lines showed fair resistance (low support of Alectra), only the line ITK99K-494-6 was most consistent in yield at most sites. While yield is of interest to farmers, continued growing of susceptible cultivars promotes build-up of the seed bank. As *A. vogelii* is a parasite of other common legume crops in Malawi, such as groundnuts and soybean (Kabambe et al., 2008a), it is therefore sound management to reduce build up through planting varieties which support minimal *Alectra*, especially where yield is not compromised as is the case with IT99K-49-6. The *A. vogelii* may be managed through trap crops (false hosts) such as dolichos bean, cotton, okra, sunflower, pea and faba bean (Parker and Riches, 1993; Kabambe et al., 2008b). The same crops are trap crops for managing *S. asiatica* when grown in rotation or intercrops with cereals (Kabambe et al., 2005; Parker and Riches, 1993; Kabambe et al., 2002; Kabambe et al., 2008b; Parkinson et al., 1987; Carsky et al., 1994). By providing *Alectra*- resistant legume varieties to farmers, their choice to incorporate legumes in the farming systems improves. Legumes, including cowpeas furnish nitrogen through biological nitrogen fixation (Bado et al., 2006) and are important for integrated disease management.

The results of days to flower and maturity showed that the two of the new lines (IT99K-494-6 and IT99K825-15) were slightly late to flower and mature as compared to Sudan-1. There was no clear relationship between maturity period and yield observed. As an example, the variety IT82E-16 and IT99K-494-6 all gave highest yields at Lisasadzi in 2008/09 even though IT99K-494-6 matured at 71 days as compared to 60 days for IT82E-16. In the low altitude sites, however, IT82E-16 gave highest yields in both seasons. Earliness therefore was important in these short season areas. Results on diseases showed that no particular susceptibility or resistance for all entries such that existing pest and disease management practices would be recommended. Thus, the line IT99K-494-6 was recommended and released in January 2011 for the mid-altitude areas of Malawi due to consistence in resistance and high yield.

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