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INTEGRATED CONTROL OF NARROW AND BROAD WEEDS FOR CORN UNDER SIWA OASES CONDITIONS

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ABSTRACT

Two field experiments were conducted in Tegzerte, Siwa Research Station, Desert Research Center during summer seasonns of 2003 and 2004 to study the influence of combinations of interrow tillage (tilled or none), row width (35 or 70cm.), cover crops (*Medicago sativa* or *Sorghum bicolor*) and herbicide (Glyphosate or none) on *Zea mays* weed control and yield of maize.

Post emergence Glyphosate-resistant *Zea mays* applied at the seven-to eight-leaf maize growth stage as a post emergence. The experimental design was a randomized complete block with 20 treatments and three replications.

The sequencing process of interrow tillage, narrow rows and *Medicago sativa* cover crop are the preferable practices that were used in maize early season weed suppression prior to the post-emergence Glyphosate application**.** In the case of individual factor was the cover crops followed by interrow tillage. The best impact of marital factor in this case was the combination between interrow tillage and *Medicago sativa* cover crop. Best result, occurred at treatment combinations in the late season weed control was combining between Glyphosate herbicide, narrow rows and interrow tillage. In the case of individual and marital factor were Glyphosate and combination between Glyphosate plus narrow rows are the best, respectively.

Interrow tillage, narrow rows, *Medicago sativa* cover crop and Glyphosate herbicide are important weed management practices that can be integrated into full *Z. mays* production season.

INTRODCUTION

Maize (*Zea mays* L.) is the third most important cereal in the world after wheat and rice, FAO (Food and Agricultural Organization, 2005).Grain yield in maize can be severely reduced by competition with weeds (Najafi and Tollenaar. 2005).

Weeds represent an important variable in maize production, both economically and ecologically. Weed competition can cause yield reductions up to 70% in maize grain yield (Teasdale, 1995). Low weed pressure treatment led to 26% and 35% reductions in maize grain yield at Ikenne and Shika, respectively, while 22% and 51 % reductions, respectively, were observed due to high weed pressure (Azeez, 2009).

Weeds are considered an economic important problem for maize (Zea mays L.) growers because they can reduce yield up to 86% (Behrens, 1975).

Maize can withstand weed competition for 3–4 weeks early in the growing season and weeds that emerge at 6–9 weeks after planting do not cause significant maize yield losses. Weeding maize after the critical period of weed removal can result in up to 83% losses in grain yield (Usman *et al*., 2001).

The effectiveness of interrow cultivation in suppressing weed density in maize is well documented. (Wilson, 1993). Interrow cultivation can provide adequate weed control in maize. It was reported that interrow cultivation controlled up to 82% of the weeds in wide row crops such as maize (Forcella *et al*., 1992).

Cultural management techniques, such as reduced crop row spacing, can increase crop's ability to compete with weeds for incoming sunlight. Several studies have demonstrated the benefit of decreased row spacing on early season canopy development in cotton, corn and soybean (Culpepper and York, 2000; Tharp and Kells, 2001; Reddy. 2001).

Reduced row spacing are thought to increase weed control by increasing the competitiveness of a crop with weeds and by reducing light transmittance to the soil surface (Tharp and Kells, 2001). Teasdale (1995) showed that reduced row spacing and increased corn populations decreased weed growth in the absence of herbicides and shortened the time of canopy closure by 1 week.

In row crops such as maize with a large area of uncovered soil during early growth, there is a large potential for soil erosion and leaching of nitrate and pesticides.

The use of cover crops and mulches can reduce the germination and the development of the weed seeds and through allelopathic (Kruidhof *et al*., 2008), and mechanical effects (den Hollander *et al*., 2007), and the competition between the cover crops and the weeds for limited resources such as light, water and nutrients (Kruidhof *et al*., 2008). Cereal and legume cover crops are widely used in various cropping systems (Isik *et a*l., 2009). The use of legumes as cover crops is mainly due to soil nitrogen enrichment fixed biologically, while the use of cereals as cover crops is mainly due to their ability in reducing nitrogen leaching and suppressing weeds(Hooker *et al*., 2008).

A cover crop (living mulch) may contribute significantly to weed management (Moore et al. 1994). The number of established weed seedlings is reduced through provision of an early soil cover, whereas the harmful effect of the established weeds on the main crop is reduced through competitive suppression. Cover crops may also be introduced in a main crop for a number of other reasons. Pest control (Theunissen and den Ouden, 1982) and the improvement of soil quality (Brandfaeter *et al*., 1998) are important beneficial traits of cover crops especially in systems where pesticides are not used. Muller-Scharer and Potter (1991) proposed a late sowing of the cover crop, after establishment of the main crop, to give the main crop a head-start. Weed competition can cause substantial maize (*Zea mays* L.) yield reductions.

There was a 75% decrease in the number of weeds present when maize was interseeded with red clover or hairy vetch (Palada *et al*., 1982). In addition, cover crops can suppress weed density by competing for light (Teasdale, 1993), water and nutrients (Mayer and Hartwig, 1986) and through the production of allelopathic compounds (White *et al*., 1989). Cover crops are effective in suppressing early season weed growth, but may delay Z. mays development without reducing grain yield (Norsworthy, 2004).

Some reports, however, indicated that the growth of main crops was also sometimes suppressed because of competition for light (Hooks and

Johnson, 2001), nutrients (Feil *et al*., 1997) and or water (Box *et al*., 1980) between cover crops and main crops.

Other methods reported to suppress weeds effectively are the use of cover crops, e.g., velvetbean (*Mucuna cochinchinensis* (Wight) Burck), and sowing crops in narrow rows or high crop densities that develop closed crop canopies early in the growing season (Chikoye *et al*., 2001; Seavers and Wright, 1999).

Interseeding maize with cover crops or a combination of interrow cultivation and interseeded cover crops are possible alternative methods of weed control. Most of the weed control was due to the interrow cultivation performed prior to seeding of the cover crops.

Glyphosate has minimal environmental impact yet controls a broad spectrum of weeds and can be applied post-emergence in glyphosate-resistant *Z. mays* through the V8 growth stage (Ritchie *et a*l., 1996) or when plants are 76 cm in height (Anonymous, 2003).When glyphosate is applied soon after crop emergence, subsequent weed emergence can occur, whereas delaying glyphosate can lead to yield reductions from early season weed interference prior to application (Gower *et al*., 2002). The sequencing process of interrow tillage, narrow row and *Medicago sativa* cover crops are the best practices that were used in the early stages of weed control in maize

Integrated weed management (IWM), which involves the combination of two or more weed control practices, has been identified as a viable alternative to the current methods of weed control in smallholder farms (Akobundu, 1992) and IWM can lead to sustainable food production, minimize drudgery, and reduce the cost of removing weeds from crops.

This study was conducted to evaluate the influence of combinations of interrow tillage, row width, cover crop and herbicide (Glyphosate) on weed growth and yield of maize.

MATERIALS AND METHODS

Two field experiments were conducted in Tegzerte, Siwa Research Station, Desert Research Center during summer seasons in 2003 and 2004. Experimental treatments included all combinations potential for using interrow tillage (tilled or none), row width (35 and 70cm.), cover crops alfalfa (Medicago sativa L.) or sorghum hybrids 102 (Sorghum bicolor L.) and herbicide-resistant *Zea mays* (Glyphosate at 0.750 kg /fed, applied post-emergence, or no herbicide) without cover crop on *Zea mays* and weed growth as well as yield of maize. The experimental design was a randomized complete block with 20 treatments and three replications. Glyphosate (Round-up 360EC) applied at the seven-to eight-leaf Z. mays growth stage. The tested herbicides were sprayed with knapsack sprayer equipped with one nozzle boom and water volume 200 L./fed.

Soil sandy loam with pH value of 7.52 and organic matter of 1.85%. Soil samples were taken before planting to measure the chemical and physical soil properties as presented in tables (1 and 2).

Weeds were all removed by intertillage and hand weeding just before sowing maize. Grain maize (Zea mays L.) was planted at 35- and 70cm wide rows on19th and 17th of May in 2003 and 2004 seasons, respectively, in hills s.c. 10 (single cross 10) at a seeding rate of 20 kg/fed. The plots were irrigated immediately after sowing. Medicago sativa and Sorghum bicolor were planted after 2 weeks from planting of maize in 15-cm rows at a seeding rate of 15 and 20 kg/fed., respectively.

Table (1): Mechanical and physical properties of Tegzerte soil.

Texture	Depth (cm.)	Clay (%)	Silt (%)	Sand (%)	pH	O.M. (%)	$CaCO_3$ (%)
Sandy loam	0-30	0.00	14.95	85.05	7.52	1.85	37.60

Table (2): Chemical properties of Tegzerte soil.

Depth (cm.)	EC (ds/cm)	Soluble cations (meq/100 gm.)				Soluble anions (meq/100 gm.)			
		Na^+	K^+	Ca^{++}	Mg^{++}	Cl^-	SO_4^-	CO_3^-	HCO_3^-
0-30	8..95	43.50	1.13	34.80	4.75	64.05	18.70	0.00	2.08

Cover crop planting date (10 and 20 days after maize emergence) did not affect maize yields or the ability of interrow tillage plus cover crops to suppress the development of weed densities (Abdin *et al*., 2000).

After 21 days from sowing, maize plants were thinned to plant per hill. Scott *et al*., (1987), included that a cover crop seeding treatment 10 days after maize emergence. At this stage the maize was approximately 11 cm tall. Interceding annual ryegrass, medium red clover, or a combination of the two provided good ground cover and dry matter production without affecting the maize grain yield if they were seeded when the maize was 15 to 30 cm high (Scott and Burt, 1985).

Organic manure and calcium super phosphate fertilizers (15.5% P_2O_5 were added during soil preparation at rates of 20 m^3 and 30 kg P_2O_5 / fed. respectively. Potassium in the form of potassium sulfate (48% K_2O) was applied before the third irrigation. Nitrogen fertilizers (ammonium sulfate, 20.5% N) at the rate of 120 kg / fed. Nitrogen fertilizer was applied in three equal portions after 20, 35 and 50 days from sowing. Other cultural practices of growing maize plants were done as recommended. Interrow tillage was carried out by using the axe which were raised above the crop rows every two weeks.

Measurement of maize yield:

In both seasons, the three middle ridges for each plot were harvesting to estimate grain yield per unit area. At harvest, (after 120 days from sowing) ten guarded plants were taken from each plot to determine grain yield (ardab = 140 kg. seed).

Survey of weeds:

In both seasons, a survey of different weed species was made by collecting all species of weeds in one m^2 from each plot after 45 and 90 days from all treatments and estimates the fresh weight (gm.) for every species of weeds. Data were statistically analyzed of variance (ANOVA) and least significant difference (LSD) at 5%, method was used to least the differences between the treatment means as published by Gomez and Gomez (1984).

RESULTS AND DISCUSS ON

Early season weed suppression:

Weed species found in this study after 30-35 days from maize emergence in 2003 and 2004 included *Medicago polymorpha*, *Echinochloa colonum*, *Zygophyllum album*, *Convolvulus arvensis* and *Phragmites australis*, with more diverse and higher densities (table, 3).

Table (3): Weed species present in 2003 and 2004 seasons and their Families and Life cycle.

Weed species	Family	Life cycle [a]
Medicago polymorpha	Fabaceae	ABL
Echinochloa colonum	Poaceae	AG
Zygophyllum album	Zygophyllaceae	AG
Convolvulus arvensis	Convolvulaceae	PBL
Phragmites australis	Poaceae	PG

[a] ABL, annual broad-leaved; AG, annual grass; PBL, perennial broad-leaved; PG, perennial grass.

Total weed species diversity (gm. /m^2) was higher in combination between none interrow tillage, none cover crop and maize wide row control, Where the quantities collected per square meter, were 36.38, 59.60, 284.02, 33.91 and 51.20 gm. /m^2 than 11.91, 18.1, 73.73, 11.57 and 16.42 gm. /m^2 in the treatments which the interrow tillage, *Medicago sativa* cover crop and maize wide row were used for all above weeds, respectively.

Also found Very small amounts of previous weeds species 3.12, 6.19, 32.34, 2.98 and 4.97 gm. /m^2 with interrow tillage, *Medicago sativa* cover crop and maize narrow row compared to 28.29, 31.40, 222.33, 15.00 and 40.82 gm. /m^2 Included none interrow tillage, none cover crop and maize narrow row plots, respectively (table, 4).

The best effect of individual factors in integrated weed control were cover crops, where the weeds amounts collected per square meter were 8.15, 10.65, 63.80, 5.80 and 11.74 gm. /m^2 for all weeds, respectively. These results agree with Norsworthy, 2004 who reported that cover crops are effective in suppressing early season weed growth, but may delay *Z. mays* development without reducing grain yield.(table, 5).

While the best impact of marital factors in integrated weed control were the combination between interrow tillage and *Medicago sativa* cover crop, whereas averaged weeds collected per square meter were 7.52, 12.15, 53.04, 7.28 and 10.70 gm./m^2 for all prior weeds, respectively (table, 5). The combination of cover crops and interrow tillage reduced the weed biomass by 81 and 78%, while cultivation alone controlled 70 and 80% of the weeds (Abdin *et al*., 2000).

Evaluation the contribution of each interrow tillage, row width and cover crop to early season weed control compared with the non interrow tillage, narrow or wide row and non-cover crop treatments were studies. *Medicago* *polymorpha*, *Echinochloa colonum*, Zygophyllum *album*, *Convolvulus arvensis* and *Phragmites australis* control in 2003 and 2004 averaged 73.08% in all plots treated with interrow tillage compared to 40.47% with none interrow tillage, whereas narrow row averaged 64.04% compared to 40.47% with wide row in all late weeds at 45 days after maize emergence (table, 6) . Although *Medicago sativa* cover crop resulted control averaged 58.16% compared to 45.11 % with *Sorghum bicolor*.

The combinations between using *Medicago sativa* cover crop plus maize narrow row only control averaged 70.68% compared to 45.63% with *Medicago sativa* cover crop plus maize wide row in all late weeds. While using *Sorghum bicolor* cover crop plus maize narrow row only control averaged 54.93% compared to 35.30% using the same cover crop plus maize wide row in all plots treatments (table, 6).

The sequencing process of interrow tillage, maize on narrow row and *Medicago sativa* cover crops are the best practices that were used in the early stages of weed control in maize, where the averaged weed control was 73.30% compared to 68.95% with interrow tillage, wide row and *Medicago sativa* cover crops.

Table (4): Influence of integrated management (interrow tillage, row width, cover crop and herbicide) on fresh weed weight (gm. /m^2) in 2003 and 2004 seasons.

Treatments combinations			Weed species				
Inte-rrow tillage	Row width	Cover crop	*Medicago polymorpha*	*Echinochloa colonum*	*Zygophyllum album*	*Convolvulus arvensis*	*Phragmites australis*
			Mean 45,90 days from sowing and 2003,2004 seasons				
None	Wide	None	36.38 a*	59.60 a	284.02 a	33.91 a	51.20 a
tilled	Wide	alfalfa	11.91 cde	18.1 cde	73.73 efg	11.57 cd	16.42 cde
tilled	Wide	sorghum	20.37 c	26.3 c	93.51 cd	19.62 c	25.04 c
None	Narrow	None	28.29 b	31.40 b	222.33 b	15.00 e	40.82 b
None	Narrow	alfalfa	8.47 ef	9.20 fgh	65.12 fgh	4.3 ghi	12.00 ef
None	Narrow	sorghum	11.88 cde	13.30 efg	97.22 cde	8.4 ef	16.85 cde
tilled	Wide	None	14.25 d	23.15 d	116.69 c	13.39 c	20.23 d
None	Wide	alfalfa	7.82 efg	12.10 efg	62.48 fghi	7.29 efg	11.47 efg
None	Wide	sorghum	9.13 de	15.24 ef	73.07 efg	8.71 ef	13.34 de
tilled	Narrow	None	13.20 cd	21.44 cd	104.70 d	12.21 cd	19.36 c
tilled	Narrow	alfalfa	3.12 gh	6.19 ghi	32.34 ijk	2.98 ghi	4.97 hi
tilled	Narrow	sorghum	6.66 efg	8.36 fgh	45.12 ghij	4.27 fgh	6.7 ghi
		Herbicide					
tilled	Wide	None	14.25 c	15.20 ef	114.98 cd	13.30 c	20.03 c
tilled	Wide	Glyphosate	2.45 h	3.56 hi	23.68 jk	2.55 hi	3.93 hi
tilled	Narrow	None	13.08 cd	12.80 efg	104.54 cd	12.43 cd	18.80 cd
tilled	Narrow	Glyphosate	1.00 h	1.90 i	12.00 k	1.15 i	1.93 i
None	Wide	None	36.14 a	62.00 a	291.97 a	33.61 a	51.28 a
None	Wide	Glyphosate	4.41 fgh	8.62 gh	34.92 hijk	3.5 hi	6.28 ghi
None	Narrow	None	28.54 b	30.80 b	234.79 b	26.42 b	40.51 b
None	Narrow	Glyphosate	1.25 h	1.80 i	16.03 jk	2.02 hi	3.57 hi
		LSD 0.05	3.88	5.49	28.44	3.19	5.04

***Means within each column followed by same letter are not significantly different at 0.05 probability level according to Duncan multiple range test.**

Table (5): Influence of factors (single and double) integrated weed management extracted from the results of 2003 and 2004 seasons (gm. /m^2).

Single treatments	Weed species				
	Medicago polymorpha	***Echinochloa colonum***	***Zygophyllum album***	***Convolvulus arvensis***	***Phragmites australis***
	Mean 45,90 days from sowing and 2003,2004 seasons				
Maize wide row	36.38 a*	59.60 a	284.02 a	33.91 a	51.20 a
Maize narrow row	28.29 b	31.40 b	222.33 b	15.00 b	40.82 b
interrow tillage	13.73 c	22.30 c	110.70 c	12.80 b	19.80 c
Cover crops	8.15 cd	10.65 d	63.80 cd	5.80 c	11.74 d
Glyphosate	2.83 d	5.21 d	25.48 d	2.76 c	4.93 d
LSD 0.05	7.29	8.08	59.24	4.58	7.38
Double treatments					
interrow tillage x Maize wide row	14.25 a	15.20 b	114.98 a	13.30 a	20.03 a
Maize wide row x alfalfa	7.82 c	12.10 c	62.48 cd	7.29 b	11.47 de
Maize wide row x sorghum	9.13 bc	15.24 b	73. 07 c	8.71 b	13.34 d
Maize wide row x Glyphosate	4.41 de	8.62 d	34.92 e	3.50 c	6.28 f
interrow tillage x Maize narrow row	13.08 a	12.80 c	104.54 ab	12.43 a	18.80 ab
Maize narrow row x alfalfa	8.47 c	9.20 d	65.12 c	4.30 c	12.00 de
Maize narrow row x sorghum	11.88 ab	13.30 c	97.22 b	8.40 b	16.85 bc
Maize narrow row x Glyphosate	1.25 e	1.80 e	16.03 f	2.03 d	3.57 g
interrow tillage x alfalfa	7.52 cd	12.15 c	53.04 d	7.28 b	10.70 e
interrow tillage x sorghum	13.52 a	17.33 a	69.32 c	11.95 a	15.87 c
interrow tillage x Glyphosate	1.73 e	2.73 e	17.84 f	1.85 d	2.93 g
LSD 0.05	3.22	1.70	11.22	1.40	2.10

***Means within each column followed by same letter are not significantly different at 0.05 probability level according to Duncan multiple range test.**

On the other hand, the using of interrow tillage, maize on narrow row and *Sorghum bicolor,* control averaged was 59.58% compared to 52.04% with the previous sequence except, a widths row was wide (table, 6) .

Integration of a *Medicago sativa* or *Sorghum bicolor* cover crop with narrow row width and interrow tillage could aid early season weed suppression prior to the post-emergence glyphosate application**.**

Late season weed control:
Herbicide:

Irrespective of row width or interrow tillage, late season control of all species with Glyphosate ranged from 89.47% to 91.71% at 90 days after maize emergence. There was no effect from use of width row (narrow or wide) and interrow tillage (tilled or none) in presence of glyphosate on late season weed control, whereas averaged weeds control were 80.00, 89.30, 87.86 and 93.30% with tilled plus wide or interrow tillage plus narrow, none interrow tillage plus wide and none interrow tillage plus narrow respectively, in addition to glyphosate in all plot treatments compared to 90.58% as averaged with glyphosate only (table, 6).

The best result occurred at treatment combinations in the late season weed control was Combining between glyphosate herbicide, maize narrow row and interrow tillage followed by glyphosate herbicide, maize narrow row and none interrow tillage, Wheres the quantities available of fresh weeds (gm./m^2) for above two cases per square meter in all treatments were 1.00, 1.90, 12.00, 1.15 and 1.93 & 1.25, 1.80, 16.03, 2.02 and 3.57 gm. /m2 compared to 13.08, 12.80, 104.54, 12.43 and 18.80 & 28.54, 30.80, 234.79, 26.42 and 40.51 gm./m2 for all weeds, *Medicago polymorpha, Echinochloa colonum, Zygophyllum album, Convolvulus arvensis and Phragmites australis*, respectively (table, 4).

Glyphosate is one of the best individual factors which used in the late season weed control, Wheres the present annual weeds in the square meter 2.83, 5.21, 25.48, 2.76 and 4.93 gm./m2, while the best impact of marital factors in integrated weed control were the combination between glyphosate and narrow row, wheres the quantities 1.25, 1.80, 16.03, 2.03 and 3.57 gm./m^2 for all prior weeds, respectively (table, 5).

Interrow tillage:

Late season weed control was not significant influenced by interrow tillage**,** where the percentage weeds control were 87.58, 80.87, 83.97, 85.79 and 85.06 with interrow tillage, plus glyphosate compared to 91.71, 90.13, 90.61, 90.97 and 89.47 with none interrow tillage, plus glyphosate for *Medicago polymorpha Echinochloa colonum, Zygophyllum album, Convolvulus arvensis and Phragmites australis*, respectively (table, 6).

Interrow tillage as individual factors was third degree after glyphosate and cover crops, while interrow tillage as marital factors was first degree by compination with glyphosate herbicide (table, 5). The effectiveness of interrow cultivation in suppressing weed density in maize is well documented (Wilson, 1993).

Interrow cultivation can provide adequate weed control in maize. It was reported that interrow cultivation controlled up to 82% of the weeds in wide row crops such as maize (Forcella *et al*., 1992).

Table (6): Influence of integrated management (interrow tillage, row width, cover crop and herbicide) on % reduction of fresh weed in 2003 and 2004 seasons.

Treatments combinations			Weed species				
Interrow tillage	Row width	Cover crop	*Medicago polymorpha*	*Echinochloa colonum*	*Zygophyllum album*	*Convolvulus arvensis*	*Phragmites australis*
			Mean 45,90 days from sowing and 2003,2004 seasons				
tilled	Wide	alfalfa	67.26 g*	69.63 g	74.04 e	65.88 g	67.93 g
tilled	Wide	sorghum	44.01 j	55.87 i	67.08 g	42.14 j	51.09 j
None	Narrow	alfalfa	70.06 f	70.70 f	70.71 f	71.33 f	70.60 f
None	Narrow	sorghum	58.01 h	57.64 h	56.27 i	44.00 j	58.72 i
None	Wide	alfalfa	45.12 i	47.73 j	46.46 j	45.56 i	43.30 k
None	Wide	sorghum	35.93 k	34.17 k	37.38 k	34.95 k	34.06 l
tilled	Narrow	alfalfa	76.36 e	71.13 e	69.11 g	75.59 e	74.33 e
tilled	Narrow	sorghum	49.55 i	61.01 j	56.91h	65.03 h	65.39 h
		Herbicide					
tilled	Wide	Glyphosate	82.81 d	76.58 d	79.41 d	80.83 d	80.38 d
tilled	Narrow	Glyphosate	92.35 b	85.16 c	88.52 b	90.75 b	89.73 b
None	Wide	Glyphosate	87.80 c	86.10 b	88.04 c	89.59 c	87.75 c
None	Narrow	Glyphosate	95.62 a	94.16 a	93.17 a	92.35 a	91.19 a
LSD 0.05			1.73	0.29	0.30	0.33	0.30

Row width:

Weed control averaged for the using row width factor plus glyphosate were 95.62, 94.16, 93.17, 92.35 and 91.19% with maize narrow row compared to 87.80, 86.10, 88.04, 89.59 and 87.75% with maize wide row in all weeds, *Medicago polymorpha*, *Echinochloa colonum*, *Zygophyllum album*, *Convolvulus arvensis* and *Phragmites australis*, respectively (table, 6). Glyphosate with maize narrow row combined gave higher controlled weeds better than the use of glyphosate with maize wide row.

Influence of IWM on broad leaf weed, grasses weed and total annual weed (gm. /m^2):

Results in table (7) indicated that broad leaf weeds, grassy weeds and total annual weeds (gm. /m^2) at combinations of interrow tillage, maize sown on narrow row and *Medicago sativa* cover crop were the best combinations for weed control, Where the amount of weeds collected in the square meter were very small compared to all treatment combinations at early season weed control. Also the combinations between, interrow tillage, maize sown on narrow row and *Sorghum bicolor* cover crop- came in the second place. A shortage of weeds collected in the previous cases led to increase in maize yield.

While at late season weed control, using glyphosate, with maize sown on narrow row and interrow tillage was the best combination treatments, where the quantities available of weeds (gm. /m^2) were 2.14, 15.83, 17.97 and 15.58 compared to the values in none herbicide, wide or narrow maize row and none interrow tillage in all weeds, *Medicago polymorpha*, *Echinochloa colonum*, Zygophyllum *album*, *Convolvulus arvensis* and *Phragmites australis*, respectively (table, 7).

Influence of IWM on Zea mays grain yield:

Maize grain yield (ardab/fed.) at early season weed suppression was higher for treatments in which interrow tillage or maize narrow row and *Medicago sativa* cover crop (12.38) followed by the same treatments except Medicago *sativa* which was *Sorghum bicolor* (11.78) compared to (7.65 and 7.15) with none interrow tillage, narrow or wide row and none cover crops, respectively (table, 7).

The best maize grain yield (ardab/fed.) at late season weed control were observed at combination of interrow tillage, maize sown on narrow row and glyphosate (15.58) followed by none interrow tillage, narrow row and glyphosate (15.16) and none interrow tillage, wide row and glyphosate (14.72) compared to (7.75 and 7.25) with none interrow tillage, narrow or wide row and none herbicide, respectively (table, 7). Higher grain yields may be due to better light utilization of narrow-row *Z. mays* (Tharp and Kells, 2001).

Table (7): Influence of integrated weed management on Broad leaf weed, Grasses weed, Total annual weed (gm./m²) and Grain yield (ardab / fed.) in 2003 and 2004 seasons.

Treatments combinations			Studied Characters (2003 -2004 growing seasons)			
Interrow tillage	**Row width**	**Cover crop**	**Broad leaf weed(gm./m²)**	**Grasses weed (gm./m²)**	**Total annual weed (gm./m²)**	**Grain yield (ardab / fed.)**
None	Wide	None	70.29 a*	394.82 a	465.11 a	7.15 f
tilled	Wide	alfalfa	23.48 f	108.25 defg	131.73 efg	11.45 cde
tilled	Wide	sorghum	39.99 def	144.85 cdef	184.84 cdef	9.17 ef
None	Narrow	None	43.29 c	294.55 b	337.84 b	7.65 f
None	Narrow	alfalfa	12.77 fg	86.32 efgh	99.09 fgh	11.65 cde
None	Narrow	sorghum	20.28 def	127.37 cde	147.65 cdef	9.54 def
tilled	Wide	None	27.64 d	160.07 c	187.71 c	7.45 f
None	Wide	alfalfa	15.11 fg	86.05 efgh	101.16 fgh	7.76 f
None	Wide	sorghum	17.84 ef	101.65 defg	119.49 defg	7.10 f
tilled	Narrow	None	25.41 de	145.50 cdef	170.91 cd	8.10 f
tilled	Narrow	alfalfa	6.10 gh	43.50 hi	49.60 hij	12.38 bcd
tilled	Narrow	sorghum	10.93 fg	60.18 fghi	71.11 ghi	11.78 cde
		Herbicide				
tilled	Wide	None	27.55 d	150.21 cd	177.76 c	7.50 f
tilled	Wide	Glyphosate	5.00 h	31.17 i	36.17 ij	13.50 abc
tilled	Narrow	None	25.51 de	136.14 cde	161.65 cde	8.15 f
tilled	Narrow	Glyphosate	2.14 h	15.83 i	17.97 j	15.58 a
None	Wide	None	69.75 a	405.25 a	475.00 a	7.25 f
None	Wide	Glyphosate	7.91 gh	49.82 ghi	57.73 hij	14.72 cde
None	Narrow	None	54.96 b	306.10b	361.06 b	7.75 f
None	Narrow	Glyphosate	3.27 h	21.40 i	24.67 ij	15.16 ab
LSD 0.05			7.04	46.07	47.69	2.65

***Means within each column followed by same letter are not significantly different at 0.05 probability level according to Duncan multiple range test.**

Narrowing the row width from 70 to 35cm improved *Z. mays* grain yields an average of 15.58 and 13.50 ardab/fed. in interrow tillage, narrow and glyphosate and interrow tillage, wide and glyphosate, respectively, which equates to a 13.35% average grain yield increase, similar to that observed by Murphy *et al*., 1996**.**

Zea mays yield at late season weed control was (15.58 ardab/fed.), While was (12.38 ardab/fed.) at early season weed control.

Glyphosate treatment has 15.16 and 14.72 ardab/fed. with none interrow tillage, narrow and glyphosate and none interrow tillage, wide and glyphosate higher grain yields than 7.75 and 7.25 ardab/fed. with non-herbicide treatments, respectively (table, 7).

Impact of cover crops on *Z. mays* yield were 12.38 and 8.10 ardab/fed. with interrow tillage, narrow and *Medicago sativa* cover crop and interrow tillage, narrow and none cover crops, while were 11.78 and 8.10 ardab/fed. with interrow tillage, narrow and *Sorghum bicolor* cover crop and interrow tillage, narrow and none cover crops, respectively (table, 7). The rise in *Z. mays* productivity were 34.57 and 31.24% In both late two cases , respectively.

REFERENCES

Abdin, A., X.M. Zhou, D. Cloutier, D.C. Coulman, M.A. Faris and D.L. Smith (2000), Cover crops and interrow tillage for weed control in short season maize (*Zea mays*), Eur. J. Agron. 12: 93–102

Akobundu, I.O (1992). Integrated weed management techniques to reduce soil degradation. In: J.H Combellack, K.J Levick, J Parsons and R.G Richardson, Editors, Proceedings of the First International Weed Control Congress, Melbourne, Australia, 17–21 February, Weed Science Society of Victoria Inc, Melbourne, Australia (1992) 341pp.

Anonymous, (2003). Roundup Weathermax Herbicide. Accessed December 12, 2003. Crop Data Management Systems (CDMS).

Azeez, J. O. (2009). Effect of nitrogen application and weed interference on performance of some tropical maize genotypes in Nigeria. Pedosphere, 19: 654-662.

Behrens, R. (1975). Corn and weeds. Weeds Today, (6): 15-18.

Box Jr., J.E., S.R. Wilkinson, R.N. Dawson and J. Kozachyn (1980). Soil water effects on no-till corn production in strip and completely killed mulches, Agron. J. 72: 797–802.

Brandsaeter, L.O., J. Netland and R. Meadow (1998). Yields, weeds, pests and soil nitrogen in a white cabbage living mulch system. Biol. Agric. Hortic. (16): 291–309.

Chikoye, D., F Ekeleme and U.E Udensi (2001). Cogongrass suppression by intercropping cover crops in corn/cassava systems, Weed Sci. 49: 658–667.

Culpepper, A.S. and A.C. York (2000).Weed management in ultra narrow row cotton (*Gossypium hirsutum*). Weed Technol. 14: 19–29.

den Hollander, N.G., L. Bastiaans and M.J. Kropff (2007).Clover as a cover crop for weed suppression in an intercropping design: II. Competitive ability of several clover species. European Journal of Agronomy, 26, (2): 104-112.

FAO (Food and Agricultural Organization), (2005). FAOSTAT database for agriculture.

Feil, B., S.V. Garibay, H.U. Ammon and P. Stamp (1997). Maize production in a grass mulch system-seasonal patterns of indicators of the nitrogen status of maize, Eur. J. Agron.., 7, p. 171.

Forcella, F., Westgate, M.E. and Warnes, D.D., (1992). Effect of row width on herbicide and cultivation requirements in row crops. Am. J. Altern. Agric. 7: 161–167.

Gomez, K. A. and A. A. Gomez (1984). In “Statistical Procedures for Agricultural Research”, 2nd ed., John Wiley and Sons.

Gower, S.A., M.M. Loux, J. Cardina and S.K. Harrison (2002). Effect of planting date, residual herbicide, and post emergence application timing on weed control and grain yield in glyphosate-tolerant corn (*Zea mays*). Weed Technol. 16: 488–494.

Hooker, K.V., C.E. Coxon, R. Hackett, L.E. Kirwan, E. O'Keeffe and K.G. Richards (2008). Evaluation of cover crop and reduced cultivation for reducing nitrate leaching in Ireland, J. Environ. Qual. 37: 138–145.

Hooks, C. R. R. And M. W. Hohnson (2001). Broccoli bgrowth parameters and level of head infestations imple and mixed plantings: impact of inceased flora diverslification. Ann, Appl. Biol. 138: 269-280.

Isik, D., E. Kaya, M. Ngouajio and H. Mennan (2009). Weed suppression in organic pepper (Capsicum annum L.) with winter cover crops, Crop Prot. 28 (4): 356–363.

Kruidhof, H.M., L. Bastiaans and M.J. Kropff (2008). Cover crop residue management for optimizing weed control, Plant Soil, (10): 1007/s.

Mayer, J. B. and Hartwig, N.L., (1986). Corn yield in crown vetch relative to dead mulch. In: Proceedings of the Annual Meeting of the Northeastern Weed Science Society, (40): 34–35.

Moore, M.J., T.J. Gillespie and C.J. Swanton (1994). Effect of cover crop mulches on weed emergence, weed biomass, and soybean development, Weed Technol. (8): 512–518.

Muller-Scharer, H. and C.A. Potter (1991). Cover plants in field grown vegetables: prospects and limitations. Brighton Crop Protection Conference Weeds Brighton.

Murphy, Y. Yakubu, S.F. Weise and C.J. Swanton (1996). Effect of planting patterns on intrarow cultivation and competition between corn and late emerging weeds, Weed Sci. 44: 865–870.

Najafi, H. And T. Tollenaar (2005). Response of corn at different leaf stages to shading by redroot pigweed (Amaranthus refroflexus L.). Iranian J. Weed Sci. 1: 127-140.

Norsworthy, J.K. (2004). Small grain cover crop interaction with glyphosate-resistant corn (*Zea mays*), Weed Technol. (18): 52–59.

Palada, M. C., Ganser, S., Hofstetter, R., Volak, B. and Culik, M. (1982). Association of interseeded cover crops and annual row crops in year-round cropping systems. In: Lockeretz, W. Editor, (1982). The Fourth IFOAM Conference, Cambridge, MA, USA, pp. 193–213.

Reddy, K.N. (2001). Broadleaf weed control in ultra narrow row bromoxynil-resistant cotton. Weed Technol. 15: 497–504.

Ritchie, S. W., Hanway, J. J., Benson, G.O., (1996). How a corn plant develops. Special Report No. 48, Iowa State Univ. Coop. Ext. Serv.

Scott, T.W., Burt, R.F. (1985). Cover crops and intercrops for New York. Cornell Cooperative Extension Fact Sheet, 452 pp.

Seavers, G.P and K.J Wright (1999). Crop canopy development and structure influence weed suppression, Weed Res. 39: 319–328.

Teasdale, J. R., (1993). Reduced-herbicide weed management systems for no-tillage corn (*Zea mays*) in a hairy vetch (*Vicia villosa*) cover crop. Weed Technol. (7): 879–883.

Teasdale, J. R., (1995). Influence of narrow row/high population corn (*Zea mays*) on weed control and light transmittance. Weed Technol. (9): 113–118.

Tharp, B.E., and J.T. Kells (2001). Effect of glufosinate-resistant corn (*Zea mays*) population and row spacing on light interception, corn yield, and common lambsquarters (*Chenopodium album*) growth. Weed Technol. 15: 413–418.

Theunissen, J. and H. den Ouden (1982). Effects of intercropping with Spergula arvensis on pests in Brussels sprouts. Entomol. Exp. Appl. (27): 260–268.

Usman, A, K.A Elemo, A Bala and A Umar (2001). Effect of weed interference and nitrogen on yields of a maize / rice intercrop, Int. J. Pest Manage. 47: 241–246.

White, R. H., R.H., Worsham, A.D. and Blum, U., (1989). Allelopathic potential of legume debris and aqueous extracts. Weed Sci. (37): 674–679.

Wilson, R.G., (1993). Effect of preplant tillage, post-plant cultivation and herbicides on weed density in corn. Weed Technol.: 728–734.

المكافحة المتكاملة للحشائش النجيلية والعريضة في الذرة الشامية تحت ظروف واحة سيوه

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أجريت تجربتان حقليتان بمزرعة محطة بحوث تجزرتي التابعة لمركز بحوث الصحراء – بواحة سيوة خلال الموسمين الصيفيين لعامي 2003 ، 2004 وذلك لدراسة تأثير الجمع بين الحرث بين الخطوط (حرث أو عدمه) ، عرض الخط (35 أو 70 سم) ، محاصيل التغطية (برسيم حجازي أو سورجم العلف) ومبيد الحشائش (جليفوسيت أو عدمه) علي مكافحة الحشائش وإنتاجية الذرة الشامية.

عومل مبيد الحشائش "جلفوسيت" علي الذرة الشامية في مرحلة نمو الورقة السابعة إلي الثامنة ، كان التصميم التجريبي قطاعات تامة العشوائية مع 20 معاملة وثلاثة مكررات.

كانت العمليات المتتابعة من الحرث بين الخطوط ، الخطوط المتقاربة (35سم) والبرسيم الحجازي كمحصول تغطية من أفضل الممارسات التي استخدمت في قمع الحشائش في الموسم المبكر للذرة الشامية قبل تطبيق مبيد الحشائش "جلفوسيت" كمعاملة بعد الانبثاق. وفي حالة العامل الفردي كانت محاصيل التغطية من أحسن المعاملات تلتها عملية الحرث بين الخطوط ، وكان أفضل تأثير كعامل زوجي في هذه الحالة هو الجمع بين الحرث بين الخطوط والبرسيم الحجازي كمحصول تغطية.

بينما كان أفضل معاملة جمع حدثت لمكافحة الحشائش في المراحل المتأخرة هي الجمع بين مبيد الحشائش "جلفوسيت" ، الخطوط المتقاربة (35سم) والحرث بين الخطوط.

وفي حالة العامل الفردي والعامل الزوجي كان "الجلفوسيت" والجمع بين "الجلفوسيت" والخطوط المتقاربة علي الترتيب هم الأفضل.

يعتبر الحرث بين الخطوط ، الخطوط الضيقة (35سم) ، البرسيم الحجازي كمحصول تغطية ومبيد الحشائش "جلفوسيت"- من أهم الممارسات في إدارة مكافحة الحشائش والتي يمكن أن تدمج ضمن موسم أنتاج الذرة الشامية بالكامل.

قام بتحكيم البحث

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