

DEDICATION

*To my dearest
Father and Mother
To my husband Ashraf,
my daughter Hibba and my sons,
Ahmed and Sajid
With Love*

ACKNOWLEDGEMENTS

I am indebted to Allah the Almighty who gave me the health, strength, and patience during the course of the study.

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LIST OF ABBREVIATIONS

AHAS	Acetohydroxy acid synthase
ALS	Aceto Lactate Synthase
cm	Centimeter
CV	Coefficient of variation
DAS	Days after sowing
DMRT	Duncan Multiple Range Test
DW	Distilled water
et al	And others
fed	Feddan
Fig.	Figure
g	Gram
GA3	Gibberellic acid
Ger.	Germination
GFFP	Glass fiber filter papers
GR24	Synthetic germination stimulant
ha	Hectare
Imaz.	Imazethapyr
Kg	Kilogram
L	Litre
LSD	Least significant difference
Mg	Milligram
ml	Milliliter
mM	Mille molar
N	Nitrogen
No.	Number
PP	Page
ppm	Part per million

Pr	Probability
RCBD	Randomized Complete Block Design
SAS	Statistical Analysis System
SE	Standard error
VS	Versus
%	Percent
μL	Micro liter
μM	Micro molar
0N	Zero nitrogen
$^{\circ}\text{C}$	Degree centigrade

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ABSTRACT

During the course of this study (2009-2015) a field survey, laboratory and field experiments were conducted. The field survey was performed in 2009/10 to ascertain spread and levels of infestation, in faba bean, of the root parasitic weed *Orobancha crenata* in an area west of Berber in the River Nile State. The laboratory experiments were undertaken at the *Striga* Research laboratory at the College of Agricultural Studies (CAS), Sudan University of Science and Technology (SUST) Shambat, Khartoum North, to study the effects of urea and the herbicide imazethapyr on *O. crenata* germination and radicle extension. The field experiments were undertaken at the parasitic weed enclosure at CAS, to study the effects of imazethapyr alone and in combinations with nitrogen, as urea, on *O. crenata* incidence and faba bean (*Vicia faba*) growth and yield. The survey showed a wide distribution of the parasite as over 70% of the fields, surveyed, were infested. Most of the participating farmers (78%) abandoned planting of faba bean to wheat and vegetables. Hand-pulling was the main method of control and was practiced by 46% of the farmers. Chemical control was practiced by only 6%, while the rest of the farmers adopted no control measures. Urea at 20-60 mM, applied during conditioning, reduced germination and radicle extension significantly. Increasing urea to 70 mM or more resulted in further reductions. Conditioned *O. crenata* seeds treated with GR24, a synthetic germination stimulant, and subsequently with urea or conversely with urea and subsequently GR24 displayed inconsistent germination and radicle extension. Conditioned seeds treated with a mix of GR24 and urea displayed significant reductions in both germination and radicle extension. Imazethapyr showed inconsistent effects on *O. crenata* germination. The herbicide showed inconsistent effects on radicles extension when the seeds were treated with GR24 at 0.1 and 1 ppm. However, on germination, seeds treated with GR24 at 10 ppm

showed significant reductions in radicle extension. In the field experiments imazethapyr, irrespective of rates and application time, effected considerable to excellent (23-99%) reductions in *Orobanche crenata* infestation early in the season. The herbicide at high rate (30 g a.i. fed⁻¹) irrespective of application time was more suppressive to the parasite than at low rate (20 g a.i. fed⁻¹). Nitrogen at 40 kg fed⁻¹ (1N) as urea, irrespective of application time showed considerable suppression of the parasite late in the season. Imazethapyre nitrogen combination was slightly less suppressive than the herbicide alone. Nitrogen, alone, had no effect on number of *Orobanche* capsules. Imazethapyr at 20 g a.i. fed⁻¹ reduced capsules production considerably (28.3%). However, when combined with nitrogen significant reductions (43.3-50.2%) were achieved. Imazethapyr at 30 g a.i. fed⁻¹, alone, or when followed by nitrogen, irrespective of application time, effected significant reductions (68-85%). Unrestricted *O. crenata* infestation reduced number of faba bean leaves by (6-21%), height by (1-12%), flowers by (33%), pods by (20-38%), hundred seed weight by (1-5%) and yield by (35-47)%. Nitrogen increased the number of faba bean leaves, flowers, pods, and faba bean height and grain yield by 10-22, 9-41, 32-68, 6-16 and 7-22%, respectively over the infested control. However, it showed non-significant decrease in 100 seed weight. Imazethapyr, at 20 g a.i. fed⁻¹, increased faba bean height, number of leaves, flowers, pods, 100 seed weight and grain yield by 0-29, 0-57, 16, 0-80, 0-7 and 24-72%, over the infected controls. However, when followed by nitrogen the corresponding increments were 5-21, 28-57, 13-110, 54-71, 0 and 41-87%. Imazethapyr, at 30 g a.i. fed⁻¹, alone, increased faba bean height, number of leaves, flowers, pods, 100 seed weight and grain yield by 0-5, 0-17, 10, 29-84, 0-4 and 26-79%, respectively over the infected controls. However, when followed by nitrogen the corresponding increments were 2-17, 2-43, 4-79, 86-120, 0-36 and 63-111%. In conclusion, urea, effectively reduced *Orobanche crenata* seeds germination and radicle extension. The herbicide effectively suppressed *Orobanche* emergence, capsules production and increased

fab bean grain yield. Nitrogen, alone had inconsistent effects. However, when applied subsequent to the herbicide, it improved treatments efficacy and further increased grain yield.

ملخص الأطروحة

أجري مسح حقلي وسلسلة من التجارب المعملية و الحقلية خلال هذه الفترة الدراسية (٢٠١٥|٢٠٠٩).
أجري المسح الحقلية للتحقق من مدي الإصابة وانتشار طفيل هالوك الفول المصري في منطقة غرب بربر بولاية نهر النيل. أجريت التجارب المعملية بمعمل أبحاث البودا بكلية الدراسات الزراعية (CAS) بجامعة السودان للعلوم و التكنولوجيا (SUST) بشمبات شمال الخرطوم، لدراسة أثر سماد اليوريا ومبيد إيمازيثبير علي إنبات طفيل الهالوك و نمو الجذير. أجريت التجارب الحقلية بمزرعة الحشائش المتطفلة بالمزرعة بكلية الدراسات الزراعية بجامعة السودان للعلوم و التكنولوجيا، لدراسة أثر المبيد إيمازيثبير علي حده ومضافا بعده النيتروجين (سماد اليوريا) علي إنبات طفيل الهالوك ونمو و إنتاجية محصول الفول المصري. أظهرت نتائج المسح الحقلية إصابة الهالوك لأكثر من ٧٠% من حقول الفول المصري. معظم المزارعين (٧٨%) تركوا زراعة محصول الفول المصري واتجهوا الي زراعة القمح والخضروات. القلع اليدوي للهالوك كانت الطريقة الأساسية لمكافحة الهالوك، تمت ممارستها بواسطة ٤٦% من المزارعين و ٦% من المزارعين استخدموا مكافحة الكيماوية. بينما لم يستخدم بقية المزارعين أي نوع من المكافحة. أدي تطبيق اليوريا بمعدل ٢٠-٦٠ ملي مولر، في فترة التهيئة الي إنخفاضا معنويا في إنبات البذور و طول الجذير. الزيادة في تركيز اليوريا الي ٧٠ ملي مولر فأكثر، أدت الي زيادة في الإنخفاض. أظهرت بذور الهالوك المهيئة التي تمت معاملتها بمحفز الإنبات GR24 و بعده مباشرة باليوريا أو العكس، باليوريا و بعدها محفز الإنبات GR24، تنذبنا في الإنبات و طول الجذير. أظهرت بذور الهالوك التي هيئت في الماء وعولمت بمخلوط محلول اليوريا مع محفز الإنبات GR24 انخفاضا معنويا في إنبات البذور وطول الجذير. أظهر إيمازيثبير إنبات متذبذبا. أظهر المبيد تنذبنا في طول الجذير عند معاملت البذور بمحفز الإنبات GR24 بمعدل ٠.١ و ١ جزء من المليون. بينما التي عولمت بمحفز

الإنبات GR24 بمعدل ١٠ جزء من المليون، أظهرت إنخفاضاً معنوياً في طول الجذير. أوضحت التجارب الحقلية أن مبيد إيمازيثبير، بغض النظر عن معدل و وقت تطبيقه أدى إلى تأثير ما بين مرضي إلى ممتاز (٢٣-٩٩%) في خفض الإصابة بطفيل الهالوك في بداية الموسم. وأن المبيد بالمعدل العالي (٣٠ جرام/فدان مادة فعالة) كان أكثر فعالية في خفض إنبثاق الطفيل من المبيد بالمعدل المنخفض (٢٠ جرام/فدان مادة فعالة). النيتروجين بمعدل ٤٠ كجم/فدان، بغض النظر عن وقت تطبيقه، أدى إلى خفض معنوي في إنبثاق الهالوك نهاية الموسم. إيمازيثبير عندما أتبع بالنيتروجين أظهر أقل فعالية في إنبثاق الطفيل من المبيد على حده. النيتروجين على حده لم يكن له تأثيراً في خفض إنتاج كبسولات الهالوك. المبيد بمعدل ٢٠ جرام/فدان مادة فعالة، أدى إلى خفض إنتاج الكبسولات بنسبة (٢٨.٣%). بينما عندما أتبع بالنيتروجين أدى إلى تأثيراً معنوياً (٤٥-٥٠%). إيمازيثبير، بمعدل ٣٠ جرام/فدان مادة فعالة على حده، أو عندما أتبع بالنيتروجين، بغض النظر عن وقت تطبيقه، أدى إلى خفض معنوي (68-85%) في إنتاج الكبسولات. أدت الإصابة بطفيل الهالوك إلى نقصان في عدد أوراق الفول المصري ما بين (٦-٢١%)، الطول ما بين (١-١٢%)، الأزهار (٣٣%)، الكبسولات ما بين (٢٠-٣٨%)، وزن المئة حبة ما بين (١-٥%) و إنتاجية الفول المصري ما بين (٣٥-٤٧%). أدى تطبيق النيتروجين إلى زيادة في عدد أوراق، أزهار و كبسولات الفول المصري و طول و إنتاجية الفول المصري بنسبة ١٠-٢٢%، ٩-٤١%، ٣٢-٦٨%، ٦-١٦% و ٧-٢٢%، على التوالي. بينما أدى إلى نقصان غير معنوي في وزن ١٠٠ حبة. إيمازيثبير بمعدل ٢٠ جرام/فدان مادة فعالة، أدى إلى زيادة في طول الفول المصري، عدد الأوراق، الأزهار، الكبسولات، وزن ١٠٠ حبة و إنتاجية الفول المصري ما بين ٠-٢٩، ٠-٥٧، ١٦، ٠-٨٠، ٠-٧ و ٢٤-٧٢% مقارنة بالشاهد. بينما عندما أتبع بالنيتروجين كانت الزيادة ما بين ٥-٢١، ٢٨-٥٧، ١٣-١١٠، ٤٥-٧١، ٠ و ٤١-٨٧%. إيمازيثبير، بمعدل ٣٠ جرام/فدان مادة فعالة على حده أدى إلى زيادة في طول الفول المصري، عدد الأوراق، الأزهار، الكبسولات، وزن ١٠٠ حبة و

إنتاجية الفول ما بين ٥-٠، ١٧-٠، ١٠، ٢٩-٨٤، ٤-٠ و ٢٦-٧٩% مقارنة بالشاهد. بينما عندما أتبع بالنيتروجين كانت الزيادة ما بين ٢-١٧، ٢-٤٣، ٤-٧٩، ٨٦-١٢٠، ٠-٣٦ و ٦٣-١١١%. و خلاصة لما سبق، نجد أن المبيد أعاق إنبثاق و إنتاج كبسولات الطفيل، و زاد من إنتاجية الفول المصري بصورة فعالة. النيتروجين علي حده، أظهر تأثيرا متذبذبا. بينما عندما طبق بعد المبيد أظهر فعالية المعاملة في مكافحة الهالوك وزيادة إنتاجية الفول المصري.