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DEDICATION

To the soul of my father with Almighty Allah mercy

To my mother, my wife and my children

To my sisters and brothers and brothers sons and daughters, specially Nosieba, Toka, Halima, Anfaal, Izzeldin and Olaa

With love and great wishes

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**Design, Construction and Evaluation of Flame
Emission Apparatus to Control Weeds Between
Faba Bean (*Vicia faba*) Ridges, River Nile State,
Sudan**

By

Alaeldin Mohamed Elhassan Awad Alla

ABSTRACT

The performance of designed and constructed flame emission apparatus using liquefied petroleum gas (LPG) was evaluated to control weeds between ridges in River Nile State. In the first season, different operative parameters were tested including two types of atmospheric burners hanged at 12cm height from soil surface, driven forward at 30° and 45 ° angle at walking speeds of 11, 18 and 27m/min. The fuel consumption per hour and temperature for each burner were measured in the laboratory experiment. In season 2004-05 a field experiment with the combination of the above parameters was executed to control weeds in faba bean at 4, 5 and 6 weeks after sowing (initiative flowering stage and initiative pod setting stage).

From the results of this season, the relation between fuel consumption (kg hr^{-1} and kg ha^{-1}) and weeding efficiency were assessed, using the burner with 1mm orifice diameter directed at 30° angle and driven at 11m/min. In the following two seasons, an experiment was conducted to evaluate flame weeding at 4 and 6 weeks after sowing, and another experiment for comparison with hand weeding and pre-emergence herbicides. The experiments were arranged in randomized block design with 6 and 4 replications respectively.

The flaming apparatus showed reasonably high efficiencies, to control grasses and broad-leaved at 4 weeks after sowing the efficiencies were 72.4% and 77.8% respectively. Comparison of means of total weeding efficiency at different weeds developmental stages showed that flaming at 4 weeks after sowing was comparable with hand weeding at the same period in the first season, and with pre-emergence herbicides; free weed and hand weeding in the second season. With regards to comparing the flame weeding with the usually pre-emergence herbicides and hand weeding, statistical analysis showed no significant difference in total weeding efficiency in the first season between the three methods, but there was significant difference ($P>0.01$) in the second season. This can be attributed to the large number of grasses which were difficult to be controlled, compared to broad-leaved weeds. The grain yield of faba bean flamed at 4 weeks after sowing was comparable with the yield of pre-emergence herbicides and hand weeded plots in the two seasons.

Economic analysis of using flame weeding at 4 weeks after sowing resulted in 562% and 1094% marginal rate of return in the two seasons, where herbicides application gave 90% and 314%, the analysis excluded hand weeding which appeared economically not feasible.

It is apparent that flaming apparatus shows promising results in terms of weeding efficiency and economic feasibility.

تصميم آلة باعثة لهب لمكافحة الحشائش بين سرابات الفاول المصرى فى وآية نهر النيل، السودان وتنفيذها وتقومها

علاء الدين محمد الحسن عوض الله

الخلاصة

قامت هذه الدراسة على تصميم آلة قاذفة لهب بإستعمال غاز البروبان (غاز المو قد المنزلى) لمكافحة الحشائش بين السرابات فى وآية نهر النيل. فى الموسم الأول تم إختبار الجهاز المصمم تحت عوامل تشغيل مختلفة تضمنت إستعمال نوعيين من المشاعل ذو فتحة 1 و 2 ملم ، علق على إرتفاع 12 سم من سطح التربة بزاوية 30 أو 45 درجة للأمام بسرعات سير 11، 18 و 27 متر/د قيقة لمكافحة الحشائش بين السرابات بعد 4، 5 أو 6 أسابيع من الزراعة فى محصول الفول المصرى. فى المعمل تم قياس درجة حرارة اللهب وإستهلاك الوقود فى الساعه لكل مشعل وفى الحقل تم تقييم إستهلاك الوقود فى الهكتار وكفاءة مكافحة الحشائش. من نتائج هذا الموسم تم تقييم أنسب عوامل تشغيل من ناحية معدل إستهلاك الوقود وكفاءة مكافحة الحشائش إستعمال المشعل ذى فتحة 1 ملم بزاوية 30 درجة وسرعة سير 11 متر/د قيقة. فى الموسمين اللاحقين تم تنفيذ تجربة بإستعمال اللهب لمكافحة الحشائش بعد 4 أو 6 أسابيع من الزراعة (بداية مرحلة إزهار الفول) ، وتجربة أخرى لمقارنة إستعمال اللهب مع المكافحة اليدوية أو إستعمال مبيدات قبل الزراعة الموصى بها لمكافحة الحشائش فى الفول المصرى. تم تنفيذ التجريبتين فى تصميم كتلة عشوائى بسته واربعه مكررات على التوالى.

من التحليل الإحصائى للنتائج وجد أن أداء الآلة أظهر قيم واعدة فى مكافحة الحشائش وصلت بالنسبة للنجيليات وذات الاوراق العريضة 4 و 8.72 و 77% على التوالى متوسط الموسمين. م مقارنة متوسطات الكفاءة الكلية على حسب مراحل نمو الحشائش (4, 6 اسابيع)، فى الموسم الاول ظهر أن إستعمال اللهب بعد 4 أسابيع من الزراعه يمكن م قارنته بالمكافحة اليدوية فى نفس الفترة، وبإستعمال مبيدات قبل الزراعة والمكافحة اليدوية فى الموسم التالى. أما بالنسبة لم مقارنة إستعمال اللهب مع طرق المكافحة السائدة، من التحليل الإحصائى ليس هناك فرق معنوى فى الكفاءة الكلية لمكافحة الحشائش بين الطرق تحت الإختبار فى الموسم الأول، فى الموسم التالى كان هناك فرق معنوى ($P > 0.01$) يمكن أن يعزى إلى وجود عدد أكبر من الحشائش النجيلية والتي تصعب إبادتها م مقارنة مع الحشائش ذات الاوراق العريضة .

من التجريبتين وجد أن إنتاجية الفول المصرى المعامل باللهب بعد 4 اسابيع من الزراعه يمكن م قارنته بإنتاجية المعامل بمبيدات قبل الزراعة والمكافحة اليدوية فى الموسمين. التحليل الإقتصادى أظهر أن إستعمال اللهب أعطى معدل عائد 562% ، 1094% فى الموسمين فى حين كان عائد إستعمال مبيدات قبل الزراعة كان 90% و 314,7%.

وعليه يتضح جليا أن الآلة تعطى نتائج واعدة بالنسبة لمكافحة الحشائش وذات جدوى إقتصادية عالية.