FINAL REPORT

Nitrogen requirement of canola under irrigation
M121/150

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Project title		**The nitrogen requirement of canola under irrigation**
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Abstract

The animal feed industry of South Africa relied on more than 842 000 tonnes of imported oil cake annually to satisfy their protein demand in 2005/06. An increase in the local production of canola will ease this reliance and can serve as a rotational crop in current disease stricken crop systems under irrigation. Fertilisation is the largest single cost-of-production-item of dry land canola production in South Africa. This will most likely also be the case for irrigated canola. Scientifically determined fertilisation guidelines for irrigated canola in South Africa are currently not available and those from elsewhere are confusing. The aim of this project was to determine guidelines for N fertilisation of irrigated canola. Field trials were planted during the winters of 2004, 2005 and 2006 on a sandy textured soil at Vaalharts and a loamy soil at Potchefstroom. Six fertilisation rates varying from zero to 300 kg N ha^{-1} were applied on two cultivars. Biomass samples were taken on three occasions from the vegetative to the beginning of flowering stages during the 2004 and 2005 seasons and four times during 2006 and analysed for N content for the purpose of determining a N dilution curve. At the appropriate stage, the crops were harvested, the yield determined and the seed from both localities analysed for oil and protein contents.

Collected data on the biomass were not sufficient to develop a dilution curve, it however, fits a N dilution curve determined for winter oil seed rape in Europe well and therefore applies for canola as well. Calculated optimum yields and associated N rates showed a high degree of variability among seasons and localities. However, a general N fertilisation rate for irrigated canola of 204 kg ha^{-1} is appropriate when a target yield is not taken into account. The delta yield procedure however, where the soil N supply and yield potential are both taken into account, shows potential as a reliable method for

determining the N fertilisation rate and can be calculated with the equation: N fertilisation rate in kg $ha^{-1} = D^{0.687}$ where D = delta yield measured in kg ha^{-1}. This equation is suitable for both dry land and irrigated canola. Seed oil content was affected by cultivars in two seasons and by a relatively small N fertilisation x locality interaction in 2004 and a locality x cultivar interaction in 2005. The seed protein content was affected by all factors and interactions except for a N fertilisation x cultivar interaction, in one or more seasons. Where affected, the protein content showed an increasing trend with increasing N fertilisation rates. The inconsistency of treatment effects over seasons indicates that a complex of factors play important roles in the determination of the seed oil and protein contents of the seed.

Opsomming

Die veevoernywerheid van Suid-Afrika het in 2005/06 meer as 842 000 ton oliekoek ingevoer om aan die binnelandse vraag na proteïen te voorsien. 'n Uitbreiding van die plaaslike canolaproduksie kan dié afhanklikheid verlig en terselfdertyd ook as 'n welkome wisselgewas vir siekte geteisterde gewasstelsels onder besproeiing dien. Stikstofbemesting is tans die grootste enkele koste-item in droëland canolaproduksie in Suid-Afrika. Dit is waarskynlik ook die geval met canola onder besproeiing. Wetenskaplik bepaalde riglyne vir N-bemesting van canola bestaan nog nie in Suid-Afrika nie en riglyne van elders is verwarrend. Die doel van die projek was om riglyne vir N-bemesting van canola onder besproeiing daar te stel. Veldproewe is gedurende die winter van 2004 tot 2006 geplant op 'n sandgrond by Vaalharts en op 'n leemgrond te Potchefstroom. Ses stikstofbemestingspeile wat van nul tot 300 kg N ha^{-1} gewissel het, is gebruik. Tydens die vegetatiewe tot beginblomstadium is in 2004 en 2005 drie en in 2006 vier keer monsters geneem vir bepaling van die biomassa en stikstofinhoud ten einde 'n stikstofverdunningskurwe te bepaal. Die proewe is op die aangewese stadiums ge-oes, die opbrengste bepaal en die graan van beide lokaliteite vir olie- en proteïeninhoud ontleed.

Die hoeveelheid data wat ingesamel is, was te min om 'n verdunningskurwe daar te stel. Die data pas egter 'n kurwe wat vir winter olieraapsaad in Europa bepaal is goed en kan dus ook vir canola gebruik word. Die berekende optimum opbrengste en ooreenstemmende N-peile het groot variasie oor seisoene en lokaliteite getoon. Alhoewel wisselend, is 'n algemene N-bemestingsriglyn vir canola onder besproeiing waar 'n opbrengsmikpunt nie tersprake is nie 204 kg ha^{-1}. Die delta opbrengs waar die grond se stikstofleweringsvermoë en opbrengspotensiaal in ag geneem word, toon potensiaal as betroubare maatstaf vir die bepaling van die stikstofbemestingsbehoefte. Die N-bemestingspeil, in kg ha^{-1}, kan vir besproeiing én droëland verbouing bereken word met: N-bemestingspeil in kg $ha^{-1} = D^{0.687}$

waar D die delta opbrengs in kg ha^{-1} is. Die saad se olie-inhoud is deur kultivars in twee seisoene beïnvloed, deur 'n relatief klein N-bemesting x lokaliteit interaksie in 2004 en 'n lokaliteit x kultivar interaksie in 2005. Die proteïeninhoud is deur al die faktore en interaksies, behalwe 'n N-bemesting x kultivar interaksie, in een of meer seisoene beïnvloed. In gevalle waar die proteïeninhoud beïnvloed is, het dit 'n verhoging met verhoode N-bemestingspeile getoon. Die inkonsekwensie van behandelingseffekte oor seisoene toon dat die saad se olie en proteïeninhoud deur 'n kompleks van faktore bepaal word.