



The role of lupin/cereal forage crops in organic farming

Nicola Cannon

*The Royal Agricultural College
Cirencester, Gloucestershire GL7 6JS UK*

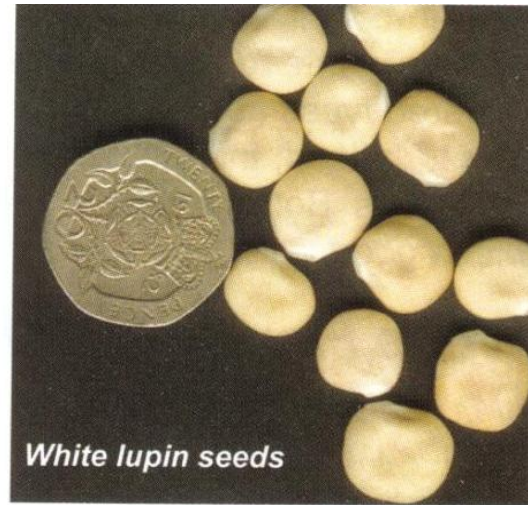
Why grow lupins?

- High protein grain (32 - 45% CP) which can substitute for imports of soya bean
- Three different species grown in the UK suit different climatic and soil conditions
- Different harvesting options: dry grain, crimped grain or wholecrop forage
- Legume crops, improves the N status of soils – well suited to organic cultivation

The nutritional properties of lupins

- Low levels of anti nutritive factors (do not need to be processed)
- Proteins are of the globulin type, digestible and bio availability are high
- Low amount of starch and high amount of energy in the form of lipids (good for mono-gastric animals)

Which Type of Lupin?



Yellow lupin
(Amber)



White lupin (Dieta)



Blue lupin (Bora)

The Challenges of Lupins

- Confusion over fodder and seed crop potential
- Often poor yields
- Not very competitive
- Late to harvest
- Intolerant of high pH
- Needs high P & K status

Harvesting options for lupins

- Combining dry grain – only possible for whites in Southern UK – often difficult without desiccation
- Crimping – harvesting moist grain (about 30% moisture) for cracking and preservation with organic acids
- Wholecrop forage for ensiling either alone or mixed with a spring cereal - more than 50% of all lupins grown currently are harvested in this way

Examples of James Southgate's work on forage lupins

Effect of:

- * species,
- * soil texture,
- * pH,
- * bulk density
- * calcium content

on root and top
growth and
nodulation



Examples of James Southgate's work on forage lupins

- Species
 - White / Blue / Yellow
 - Sown at the suggested target population \pm
- Sowing Dates
 - Late March
 - Late April / Early May
- Six Contrasting Sites from Essex – Wales
- Work carried out over two years

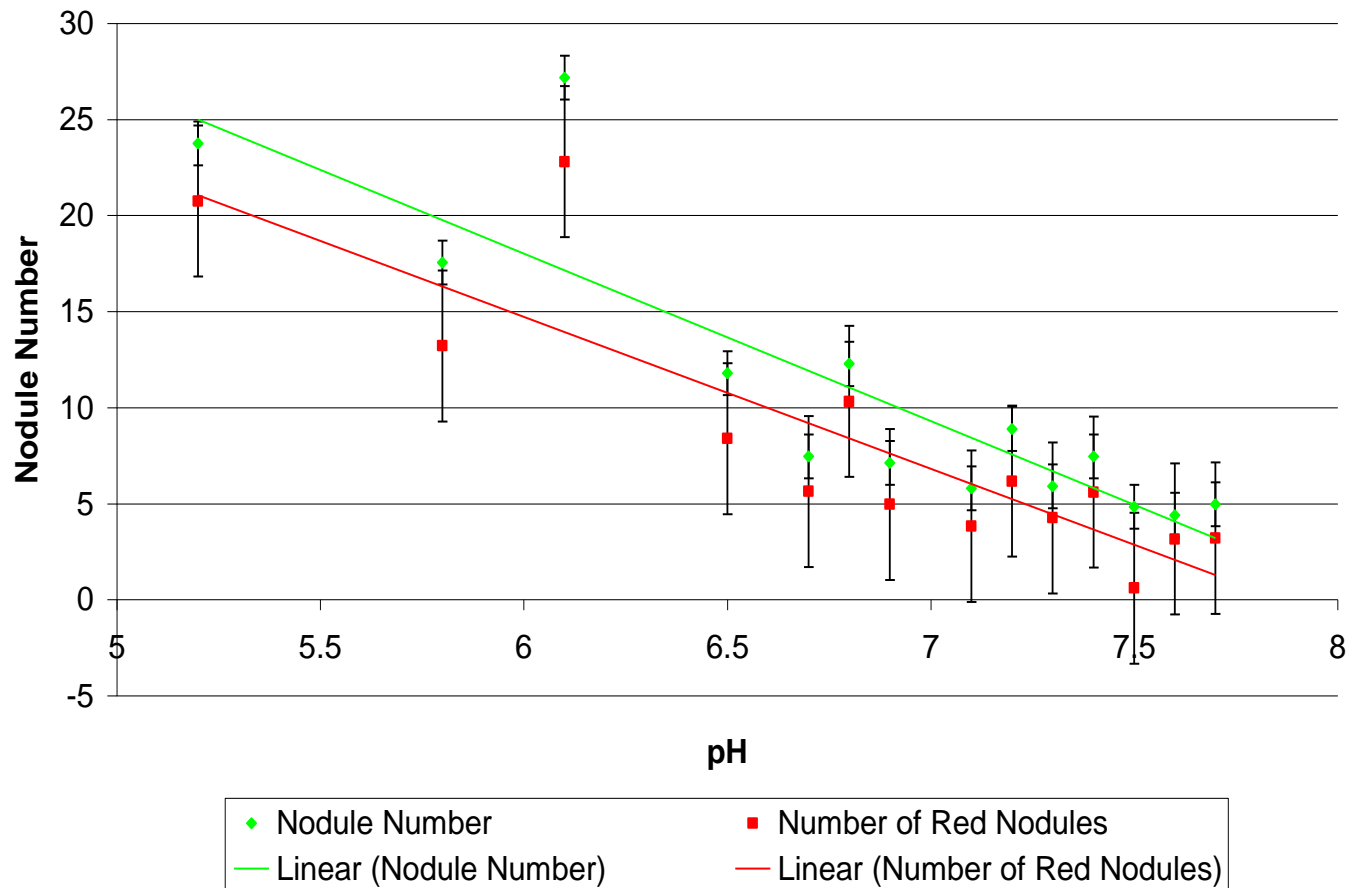


Examples of James Southgate's work on forage lupins

- Four harvest times to establish best harvest date
- Samples at each harvest ensiled in sealed silage bags
- Assessing yield, nutrient content & quality of silage
 - Early = Too wet & lower yield
 - Late = Higher Yield but too dry to ensile
- Different maturity rates between species



The effect of soil pH on nodulation in lupins



Examples of Winnie Azo's work on organic lupin/cereal bi-crops

Aim was to establish optimum combinations of lupins and spring cereals for ensiling under organic conditions



Examples of Winnie Azo's work theory of bi-cropping

- Higher yields and yield stability (Ofori and Stern, 1987)
- Improved forage quality (Chapko *et al.*, 1991)
- Better weed control (Inter-crop report, 2006)
- Efficient land use (Kwabiah, 2004)
- Ecological and economic advantages (McKenzie & Spaner, 2002)



Organic yellow lupin / triticale
bi-crop at Harnhill, June 2005

Examples of Winnie Azo's work - bi-crop trials

Field trials on all three lupin species with a range of cereals were carried out in 2005

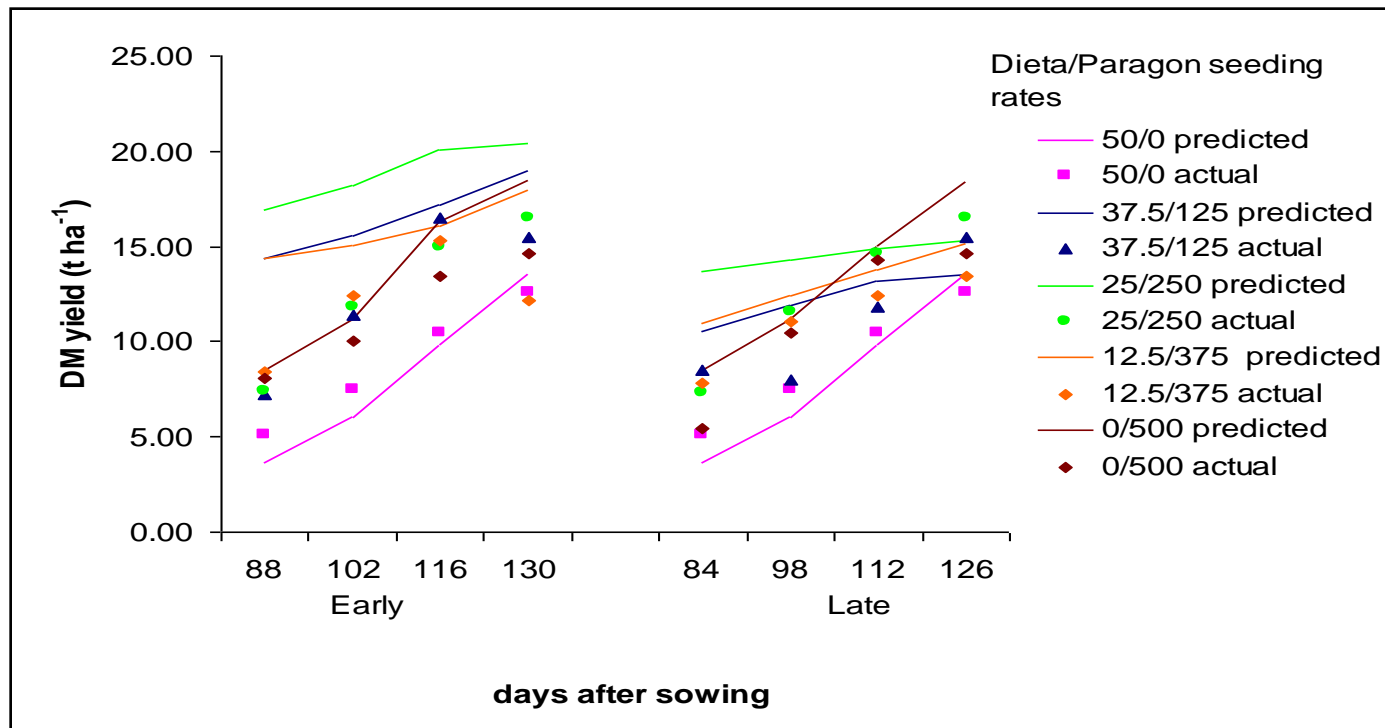
Dieta white lupin, Paragon spring wheat and Logo spring triticale were selected as the best constituents for further study in 2006



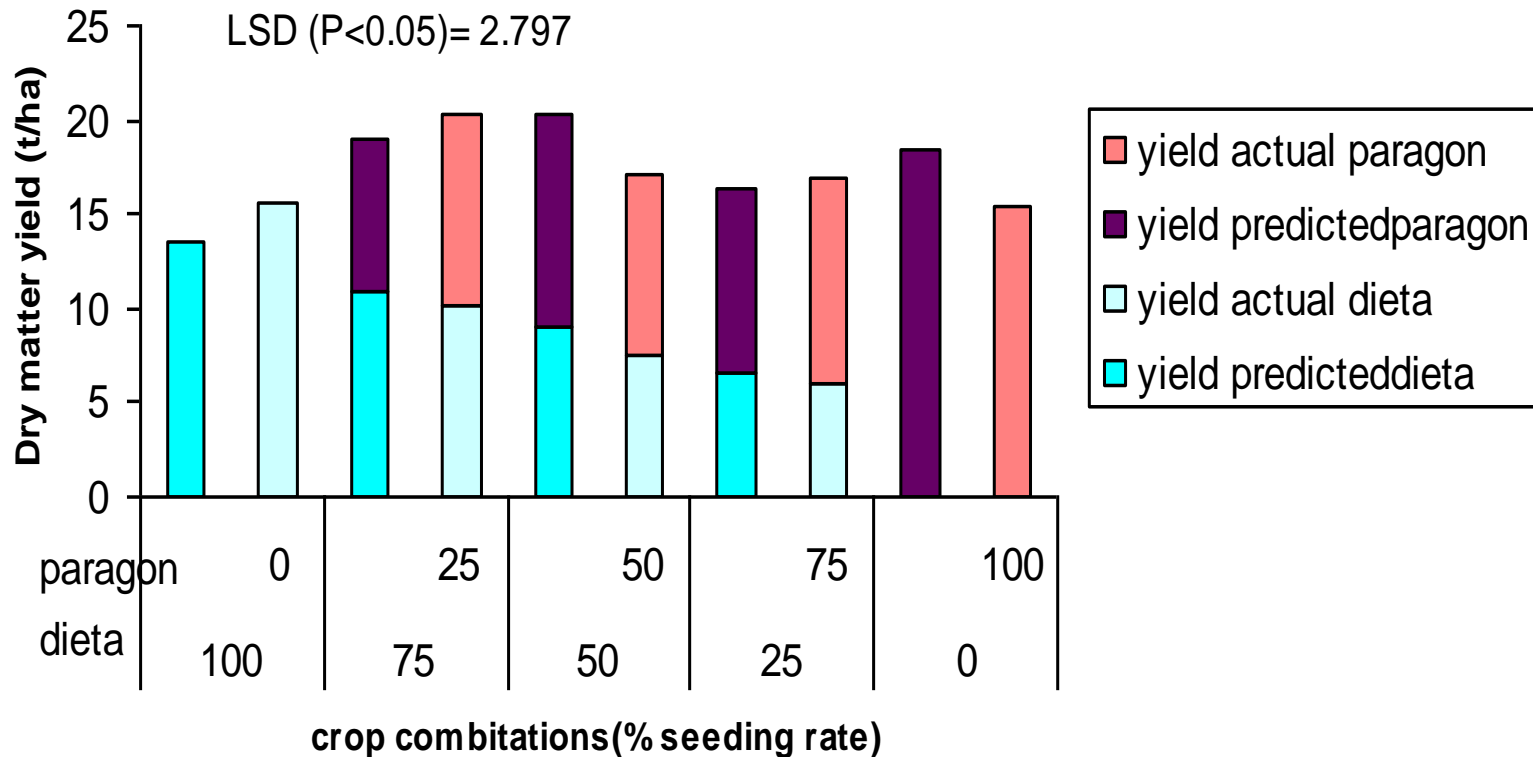
Dieta white lupin and Logo triticale at the early stages of growth (2006)

Winnie Azo's work -using the Conductance model

Key relationships are those between DM (t ha^{-1}) and time for Dieta / Paragon. $r^2= 0.61$ (early) and 0.74 (late) $P<0.01$

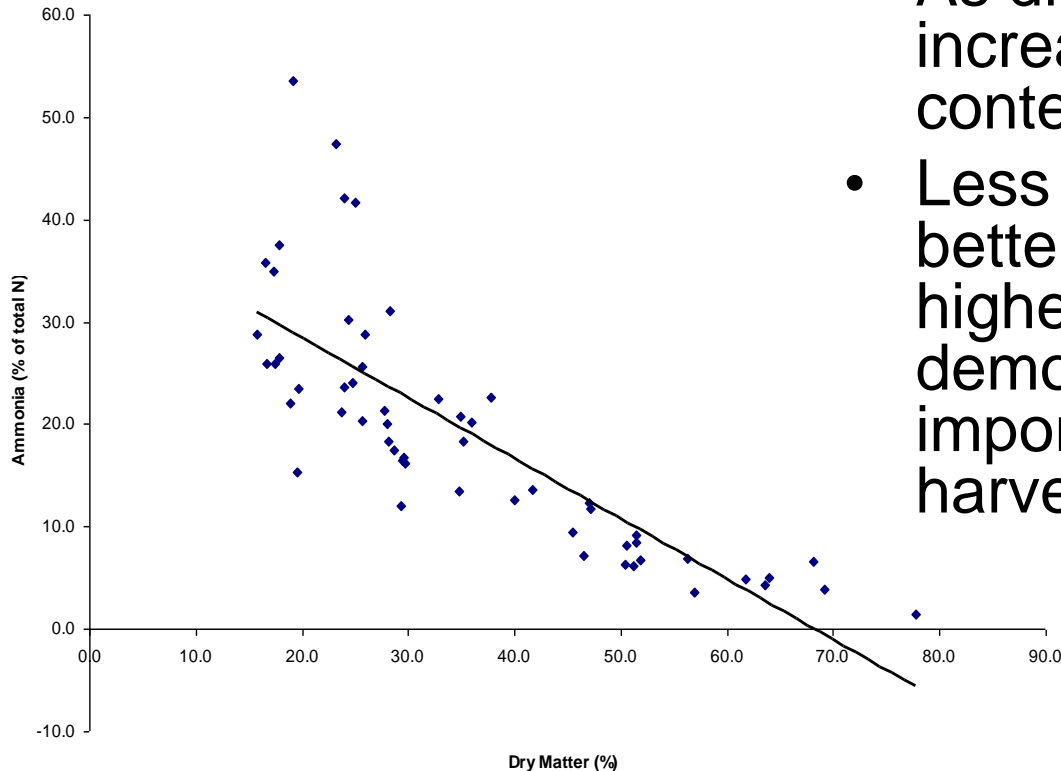


Comparing model predictions with bi-crop field trials - 2006 results



Dry matter yield (t/ha) for Dieta / Paragon during the 2006 growing season. LSD value for comparing actual yields. $r^2=0.7521$ (regression for predicted against actual yield)

Examples of Winnie Azo's work – lupin/cereal bi-crop silage quality



- As dry matter % increased ammonia content decreased
- Less spoilage and better fermentation at higher dry matters – demonstrating the importance of later harvests

Relationship between the ammonia content and dry matter % of the silages
 $r^2=0.8035$ ($P<0.01$)

Conclusions

- Lupin/cereal bicrops can provide high quality forage under organic conditions
- Dieta (white lupins (*Lupinus albus*)) were the most reliable and predicable regarding both quality and yield
- Either spring wheat or triticale are both suitable crop partners to lupins
- Later harvest dates helps increase dry matter whilst also improving silage quality
- Harvesting at 130 days after sowing or slightly earlier was optimum for CP yields

Thank you!