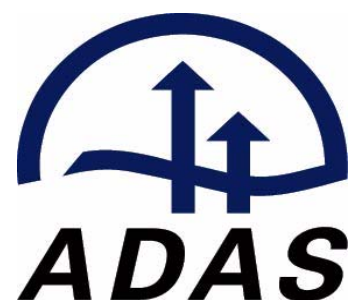


**Effect of Combination Drilling Nitrogen on Winter Oilseed
Rape and Second Winter Wheat.**

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SUMMARY

This report details an investigation into the effects of combination drilling autumn nitrogen with a winter oilseed rape and second winter wheat crop. The report is based on work done in an un-replicated trial on one site in the 2002/03 cropping year. None of the report findings constitutes a recommendation.

The oilseed rape crop did not respond to the applications of drilled autumn nitrogen, with no significant difference between any of the treatments. The field yield average was 3.7t/ha and the lowest yield from the DAP treated plot was 3.5t/ha. An observation from the trial was that the urea treated plot had the lowest plant count possibly indicating that urea is not the best choice of nitrogen source in the dry conditions.

The application of autumn nitrogen to the winter wheat crop caused an increase in yield of between 0.5 and 0.8 tonnes per hectare, which is significant. Although there were no visible differences between the treatments through the growing season it is likely the application of 40kg/ha of nitrogen in the autumn with the addition of a dry spring caused this increase in yield.

BACKGROUND

The use of autumn nitrogen is regarded by many as a useful management tool for manipulating early autumn crop development. Winter sown crops such as oilseed rape and wheat can suffer reduced economic performance if development is unduly retarded going into the spring.

In oilseed rape crops it is desirable for the crop to emerge quickly and evenly and achieve canopy closure as soon as possible. Rapid canopy closure can assist in both grass and broad-leaved weed suppression and also reduce the likely impact of winter pigeon grazing. In an attempt to promote higher yields and reduce expenditure on variable costs autumn applications of nitrogen to winter rape have now become quite routine.

Autumn applications of nitrogen to wheat crops are less widely accepted and practised as in the past much research has proved there is little significant benefit to margin from doing so. This would form the opinion of many growers and farm advisors alike.

However farming practices have modified over the last decade to include much more second wheat in the rotation and the use of faster non-inversion crop establishment techniques. It is in this second wheat situation where there could be a potential benefit to autumn applications of nitrogen as: -

- 1) there is less residual nitrogen in the soil for a second wheat crop
- 2) non inversion primary cultivation will mineralise less soil nitrogen than ploughing
- 3) higher volumes of straw on the soil surface and immediate rooting zone will reduce and delay the release of autumn/early spring soil nitrogen.

To permit the use of autumn nitrogen not least under NVZ (Nitrate Vulnerable Zones) legislation there must be a specific “crop requirement” for the application. The crop requirement for autumn nitrogen must be based on substantiated evidence. This report would not constitute “substantial evidence” under Environment Agency scrutiny.

METHOD

The trial was sited in two fields

- a) 27.66 ha of Winter Oilseed Rape drilled 30/08/02 following a run of 3 wheat crops.
- b) 23.96 ha of Winter Wheat drilled 04/10/02 following a 1st wheat.

These fields were selected as the soil type is a consistent Hanslope series clay across both fields. The location of the fields is Elsworth Cambridgeshire. Each field was split into 4 treatments of similar size (approximately 4 hectares) and ran with the tramlines for the full length of the field. A Simba Solo (inc. press) was used as the primary cultivator in both fields. Secondary cultivation was confined to the headlands which received a light pass with a power harrow.

Seed rates were calculated based on 1000-grain weight, germination and were specific to field conditions at the time of drilling. No allowance was made for the fact the nitrogen was being applied at the time of drilling.

The drill used was a Vaderstad RDA 600C, which precisely drilled the fertiliser at 500 mm spacings in between the crop rows. The fertiliser was placed at a consistent depth 30mm below the seed. The drill was re-calibrated between changes in fertiliser. Both fields were rolled immediately after drilling (same day).

Three types of fertiliser were used to appreciate any differences in the form of nitrogen applied. Each fertiliser was in the solid form. The 3 forms of nitrogen fertiliser were:

- 1) Di-ammonium Phosphate (18% N)
- 2) Urea (46% N)
- 3) Ammonium Nitrate (34.5% N)

Each fertiliser was drilled/applied so that each supplied the equivalent of 40kg/ha of nitrogen. The control plot in the oilseed rape trial received the equivalent of 40kg/ha of nitrogen in the form of liquid 12:18:00 as part the farms standard practice phosphate fertiliser application. Each plot had the same amount of spring nitrogen as the control in both the wheat and rape. Details of fertiliser applications are contained in Tables 1 & 2 overleaf.

Post drilling the crops were managed and treated using conventional commercial practices. The fields were treated as a whole with no exceptions for different plots. This was true for the agrochemicals as well as fertiliser regime. Details of the agronomic inputs are detailed in Table 3.

In an attempt to reduce error any sampling was done in the middle of the plot where fertiliser placement should have been the most consistent, i.e. the drill had settled down and not run out prior to the end of the plot.

The plots were combined using the farms own combine and yield information taken using the onboard yield meter. Yield results were taken from the middle of the plots where the combine had a full width of cut. The yields were averages of 2 – 3 runs and while they are effectively “spot” rates it was the same for each plot making comparisons meaningful.

Fertiliser Applications

Table 1. Oilseed Rape Nitrogen Applications 2002/03

Split No	Product	Date	Nitrogen (kg/ha)
1*	12:18:0	08/09/02	40
2	NS 60	22/02/03	70
3	N35S	02/04/03	120
Total Nitrogen For Crop			230

* The autumn application of liquid fertiliser was only applied to the control. None of the plots drilled with nitrogen received this application.

Table 2. Second Wheat Nitrogen Applications 2002/03

Split No	Product	Date	Nitrogen (kg/ha)
1	10:20:0	13/03/03	40
2	N35S	03/04/03	99
3	N35S	14/05/03	110
Total Nitrogen For Crop*			250

* Does not include autumn drilled nitrogen. Plot total nitrogen equalled 290kg/ha of N. Control equalled 250kg/ha of nitrogen.

Table 3. Background of Site and Agronomic Inputs

Elsworth: Winter Oilseed Rape				Elsworth: Winter Wheat			
Field Size (ha)	27.68			Field Size (ha)	23.96		
Variety	Fortress			Variety	Access		
Field Yield (Dry)	3.7t/ha			Field Yield (Dry)	9.6t/ha		
Altitude	62m			Altitude	62m		
Soil Type	Hanslope Association			Soil Type	Hanslope Association		
Soil Analysis	ph. 7.8			Soil Analysis	ph. 7.2		
	P: 27 (Index 3)				P: 38 (Index 3)		
	K: 189 (Index 2+)				K: 243 (Index 3)		
	Mg:85 (Index 2)				Mg: 118 (Index3)		
Soil Nitrogen	67 (SMN kg/ha N 0 - 90cms)			Soil Nitrogen	53 (SMN kg/ha N 0 - 90cms)		
Previous Crop	Winter Wheat			Previous Crop	Winter Wheat		
Drill Date	30/08/03			Drill Date	04/10/02		
Harvest Date	13/07/03			Harvest Date	10/08/03		
Seed Rate	5 kg/ha			Seed Rate	300 Seeds/m ²		
Total Nitrogen	230kg/ha			Total Nitrogen	250kg/ha (Liquid N35s)		
Total SO₃	65kg/ha			Herbicides	Glyphosate (Roundup Ultra)	1.0	l/ha
					Tri-allate (Avadex Excel 15g)	15.0	kg/ha
Herbicides	Tepraloxydim (Aramo)	1.0	l/ha		Flupyr-sulfuron-methyl (Lexus 50DF)	20.0	g/ha
	Propyzamide (Kerb Flo)	2.1	l/ha		Clodinafop-propargyl+ Triflurlin (Hawk)	2.5	l/ha
				Fungicides	Cyproconazole (Caddy 240EC)	0.1	l/ha
Fungicides	Difenoconazole (Plover)	0.3	l/ha		Cyproconazole+Prochloraz (Profile)	0.8	l/ha
	Metconazole (Caramba)	0.1	l/ha		Pyraclostrobin,Epoxyconazole,		
					Keroxim methyl (Opponent)	0.6	l/ha
Insecticides	Zeta-cypermethrin (Fury)	0.01	l/ha	Growth Regulators	Trinexapac-ethyl (Moddus)	0.1	l/ha
					Chlormequat 750	1.3	l/ha
				Insecticides	Cypermethrin (Toppel)	0.25	l/ha
				Trace Elements	Manganese 1000	2.5	l/ha

OBSERVATIONS

Wheat: There was no visible difference in growth stage or crop colour in any of the treatments during the growing season. Visually each treatment looked the same coming out of the winter and into the spring. Only when plant and tiller counts were taken in April were differences in crop structure evident. This was very subtle and not appreciable to the eye.

OSR: Very little difference in crop development between the plots and no difference in crop colour between the treatments. The drilled fertiliser plots did appear to encourage the levels of cereal volunteers more so than the later applied liquid application. Although this was “fairy” subjective the drilled fertiliser plots did appear to have a larger percentage of smaller plants while the control appeared to look the slightly better crop in the early spring.

Flowering was reasonably consistent across the field and no more protracted than other commercially grown crops on the farm. Crop density was perhaps a little low but this was true across all the treatments and a result of the dry autumn and spring conditions.

RESULTS

Winter Oilseed Rape

Table 4: Oilseed Rape Treatments

Crop	Fertiliser	SMN (19/02/03)	Plants per M ²	Yield (t/ha)
OSR	DAP	61	16	3.5
OSR	UREA	88	14	3.6
OSR	AN	69	16.4	3.7
OSR	CONTROL	67	16.8	3.8

Table 4 above details the results from the 3 nitrogen treated plots compared to the control. Most significantly there is no significant difference in yield. In this trial in this year the form of nitrogen source had little effect on yield. Under wetter autumn weather conditions the results may be different.

From Figures 1 to 3 it is possible to see the pattern of autumn rainfall and although 2002 was quite a dry autumn it was about on par with the average for region over the last 9 years. The pattern of rainfall was more significant, little rain falling in August and September with no significant rain (20mm/0.75 inches) until the 17th of October. As the rape was drilled on the 30th of August there was very little rain for 6 weeks post drilling. Unlike previous years there was little rain in September to compensate for the dry August and early October periods (see Fig 3) it was this low September rainfall which had the greatest influence on the plants germination and vigour.

An observation is the higher level of residual nitrogen in the soil in the urea treated plot. Although unlikely to be significant this higher amount of residual nitrogen was found in the top 30cms of soil. It is possible that one of the sampling points had a higher than normal concentration of urea (due perhaps to drill metering error or overlapping) which effected the final nitrogen analysis but not yield.

The urea treated plot had the lowest plant count out of the 4 treatments but again this had no significant impact on yield. This may suggest that urea is the least suited fertiliser for use in this manor at the time of rape sowing.

In addition there were no additional management or margin benefits from applying the nitrogen. For example there was very little difference between the treatments in broad-leaved weed suppression. However all three drilled nitrogen plots had significantly higher levels of cereal volunteers than the liquid post drilling application of nitrogen. These volunteers required prompt treatment and could have contributed to the reduction in rape plant population.

SECOND WHEAT

Table 5: Winter Wheat Treatments

Crop	Fertiliser	SMN (19/02/03)	Plants (m ²)	Tillers (m ²)	Yield (t/ha)
2nd WHEAT	DAP	42	240	992	10.30
2nd WHEAT	UREA	47	218	794	10.06
2nd WHEAT	AN	49	181	645	10.43
2nd WHEAT	CONTROL	53	240	874	9.51

Table 5 clearly suggests the addition of 40kg/ha of autumn nitrogen had a significant affect of increasing yield by 0.5 to 0.8 tonnes per hectare. The reasons for which can be attributed to several factors.

From the soil mineral nitrogen testing there was little difference between the treatments in terms of residual or available nitrogen levels. This would suggest that the additional nitrogen the 3 treatments received over the control was either taken up by the plants or leached over the winter period.

In early March when the soil mineral nitrogen tests were taken there were no visible differences in the crop height of the 4 treatments and no discernible differences in crop colour. All 4 treatments had emerged and matured at the same speed with no visible colour or height differences between the plots.

Based on these observations it would be easy to conclude that the autumn nitrogen was leached out of the system before the plants could fully utilise it but the yield difference between the treatments would suggest otherwise. The fact there was a difference between the yields of the treated and untreated crops must lead us to conclude that in fact the autumn nitrogen was in the plants and that the SMN tests and visual assessments made were too crude to detect such subtle differences.

From the yield evidence and in the absence of more sophisticated/appropriate/replicated nitrogen testing, it is reasonable to assume sufficient autumn nitrogen found its way onto the treated plants. It was this autumn nitrogen that in a dry spring when spring applications of nitrogen were slow to get into the plants that created the yield difference. Figure 2 highlights the spring rainfall figures averaged approximately 13mm (0.5 inches) for February, March and April 2003 with no significant rain until 12th of May.

The ammonium nitrate treated plot had less plants per square meter in the spring and could not compensate to produce the same amount of tillers as the other 3 treatments. In a season where spring water availability was limited this treatment befitted from having fewer tillers and utilised the water better than the other treatments with less tiller die back. It is likely this better utilisation of resources contributed to the higher yield of the treatment.

CONCLUSIONS

It is difficult to conclude any recommendations from such un-replicated treatments but certain points can be discussed.

Drilling autumn nitrogen with the oilseed rape crop proved to have no significant effect on yield. Indeed the rapid growth of volunteer cereals could easily become a negative effect of autumn nitrogen applications. In a wetter year with increased soil moisture the crops may have responded better to the drilled nitrogen but in addition so could the volunteers and weeds.

Most growers will apply nitrogen early post emergence to winter oilseed rape after an assessment of emergence and the crops potential. Although this ties up labour during the farms busiest period and can be a hassle, this investigation would suggest there is little to be gained from altering the system and combination drilling nitrogen fertiliser with the crop.

The response of the second wheat crop to such a small amount of nitrogen applied right at the start of the season is surprising. There can be little doubt that the significance of the results was largely due to the dry spring period. Although the 1st application of nitrogen in March was comparatively early, it is likely that it was neither early enough or supplied sufficient nitrogen to reach the yield as achieved by the drilled nitrogen plots.

It is unlikely the results would have been so significant if the autumn and spring had been wetter enabling potentially quicker/more nitrogen mineralisation and uptake. In addition it is likely the yield response would have been less if the trial were sited on a less responsive site, nevertheless these results make interesting reading and would suggest further investigation is necessary.

Figure 1: AVERAGE MONTHLY RAINFALL FOR THE SITE – AUGUST TO OCTOBER 2002

Average Autumn Rainfall (August - October)

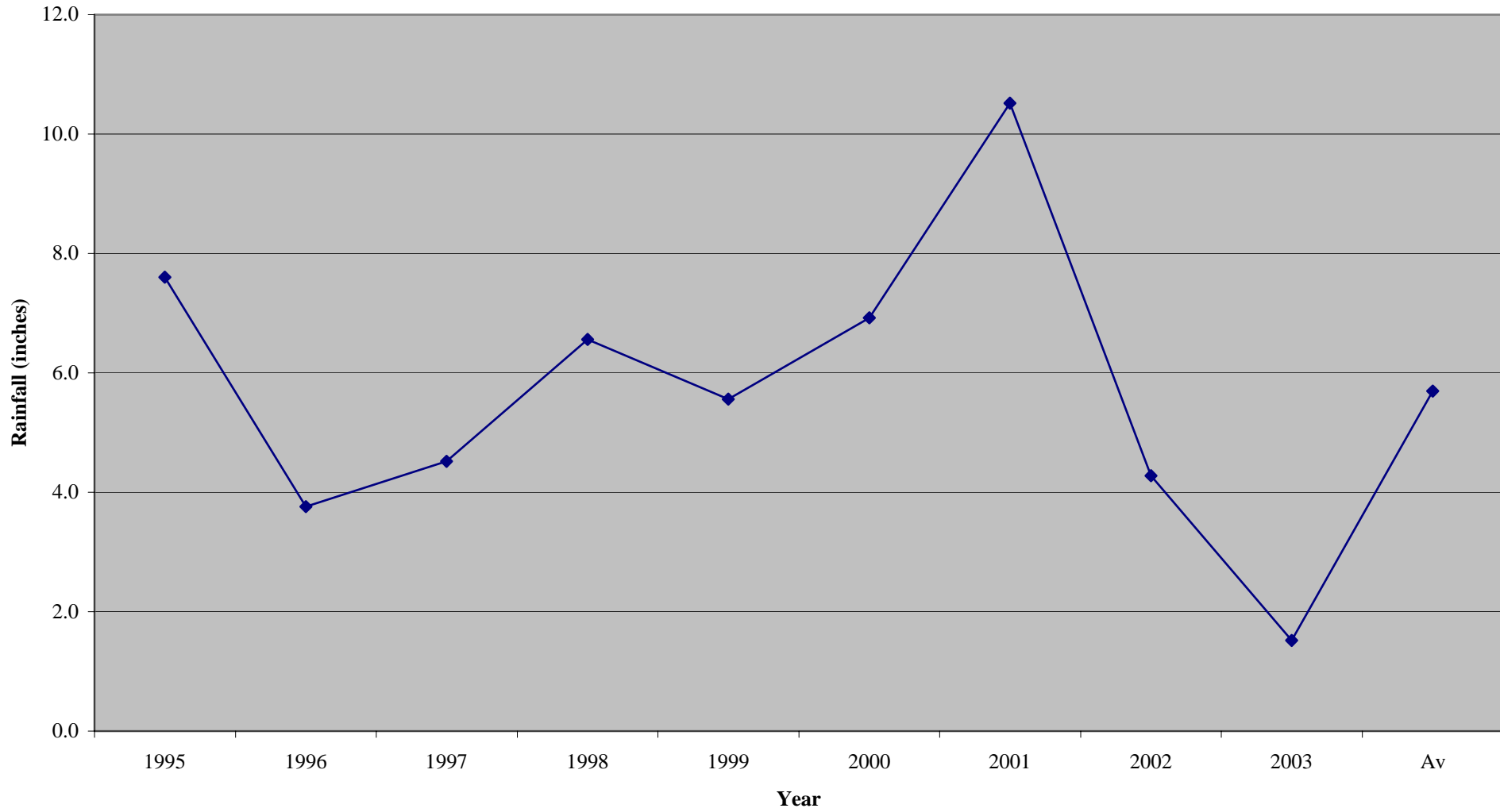


Figure 2: ANNUAL RAINFALL FOR THE SITE FROM DRILLING 2002 TO HARVEST 2003

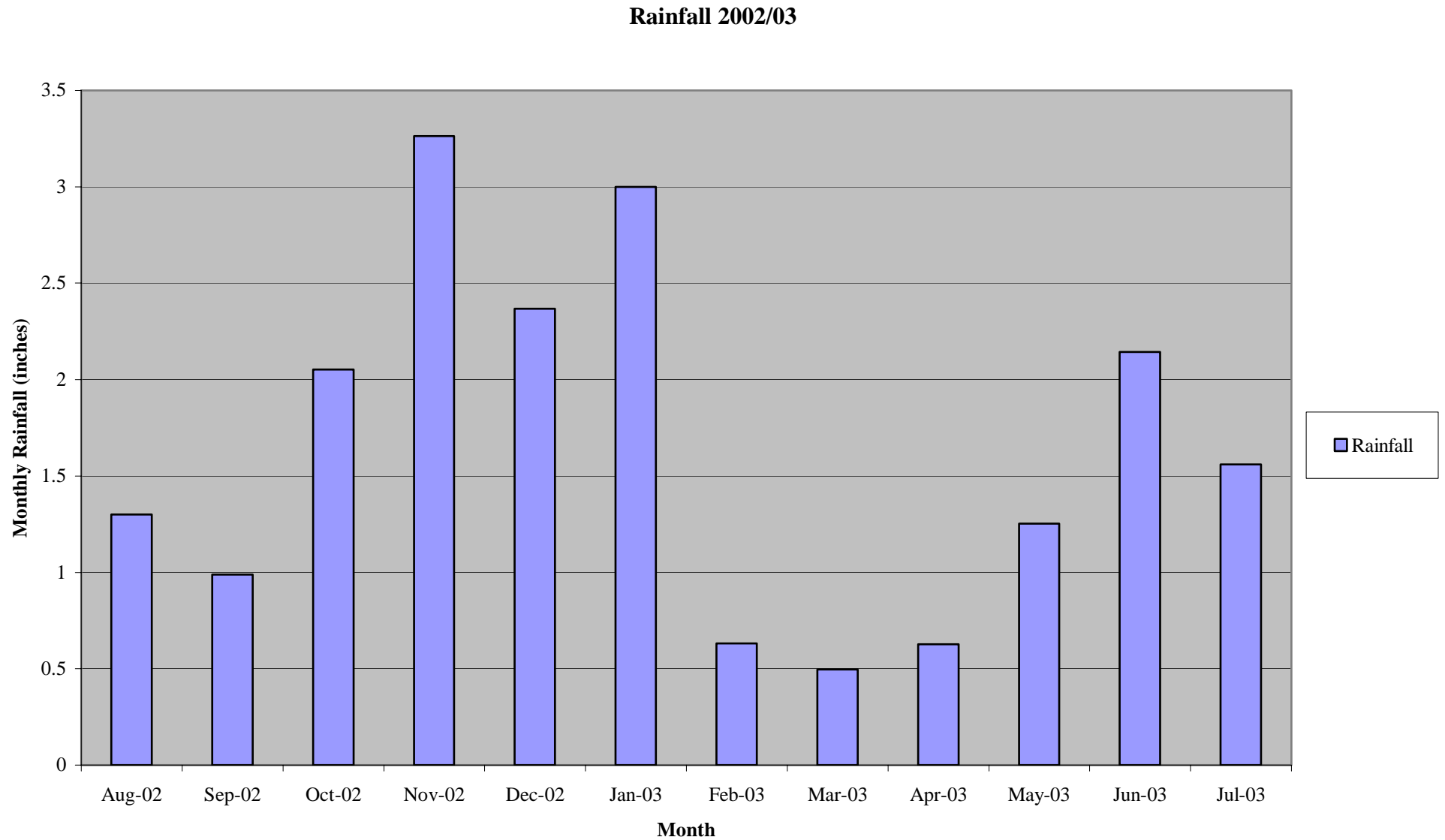


Figure 3: RAINFALL THROUGH ESTABLISHMENT PERIOD - AUGUST – OCTOBER 2002

Autumn Rainfall

