PHENOLOGY AND GRAIN YIELD OF FIELD PEA IN THE NORTHERN CROPPING BELT

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Summary. The acceptance of field pea as a commercial winter grown pulse crop in the northern cropping belt, (northern NSW and southern QLD), will depend on its ability to compete successfully with existing crop species. The determination of optimum phenology and plant type for the region is critical to its establishment. Time of sowing experiments were conducted at Narrabri with a range of introduced field pea germplasm diverse for maturity and plant type, viz., conventional, semileafless and tare. Grain yields indicated that for the genotypes evaluated late May was the optimum planting time irrespective of plant type. However, semileafless types as a group consistently outperformed tare and conventional leafed peas. Yield constraints identified included standability, time to and duration of flowering, foliar and seed borne diseases and frost.

INTRODUCTION

The use of a winter grown pulse crop in rotation with cereals in the northern cropping region has been accepted by growers as an effective tool in the battle for sustainability. By the 1980's declining wheat yields and/or grain protein (1) caused growers in the northern cropping region to consider pulses as one alternative. The pulses thought at that time to offer the most promise were lupin, chickpea and faba bean (2). The advantages offered included increased soil fertility, more effective weed control and disease breaks. Grain yields of the two major pulses which have been grown in the northern cropping region, (faba bean and chickpea), have been erratic since their introduction in the early 1980's (3). This "boom or bust" nature of production has been a limiting factor in widespread acceptance of pulses as a viable economic alternative. Poor phenological adaptation, diseases, viruses, waterlogging and poor adaptation to high pH soils have been the major problems associated with production.

Field pea (*Pisum sativum*) is considered to be the most adaptable of the winter pulses and has been a long established rotational crop in the medium winter rainfall cereal growing areas (400-550) of Victoria, South Australia and Western Australia (4). Long term grain yields for this crop have averaged 1-1.5 t/ha (approximately half the average yield of wheat). In more recent years (1982-83) there has been an expansion of field pea production into southern and central NSW with modest acreages planted each year (5). Field pea production in Australia peaked in 1991-1992 (423,000 ha) and has declined gradually since that time (3).

To date field pea production in the northern cropping region has been restricted to a limited number of farmers experimenting with small areas of named cultivars. Success has been limited by the poor adaptablity of the cultivars grown, in particular standability and phenological adaptation. The development of germplasm aimed at increasing standability (6,7) eg., semileafless and tare cultivars in the northern cropping belt will assist in the selection of better adapted varieties.

MATERIALS AND METHODS

Time of planting experiments were conducted at the University of Sydney Plant Breeding Institute Narrabri during 1993 and 1994 with a range of field pea cultivars. Entries were chosen to represent a range leaf types and included Bonzer and Dinkum (semileafless), Progreta (tare) and Wirrega, Trapper, Collegian, Pennant, Rondo, Prussian Blue, Buckley, Massey Gem, Dun and Huka (conventional). Within the convential gruop there was a range of maturity types including early, mid and late. In 1993 and 1994 three times of planting were chosen, viz., 1st week May, last week in May and 2nd week in June. In 1993 the 1st planting time was partly damaged by herbicide and a plot harvest yield was not obtained. The herbicide used in 1993 and 1994 was Cyanazine 500g/l (a.i.) at 3 l/ha. In 1993 the experimental area was treated with Thiodicarb 375 g/l (a.i.) at 750ml/ha to control *Helicoverpa.* Experimental design was a square lattice with 3 replications. The plots were 7 rows with 25 cm between rows within plots and 100 cm between outside rows of adjacent plots. Plot lengths of 5 m in 1993 and 7 m in 1994 were determined by seed availability. Seeding rate was 700,000 seeds/ha in 1993 and 600,000 seeds/ha in 1994. In both years the experiments were planted into a full profile of moisture (1 m) with 20 mm water applied by sprinkler irrigation in 1993 and 40 mm applied in 1994.

Measurements

Dry matter harvests were taken at 30 days, 60 days and at harvest maturity. In 1994 the dry matter measurements were supplemented with wet matter production and a measurement of dry matter production using a single pasture probe. Measurements were taken of days to flowering. Observations were made of the effect of diseases and frost damage. Yield measurements were based on whole plot yield.

RESULTS AND DISCUSSION

The two years, 1993 and 1994 were completely different in terms of climatic conditions (table 1). The growing season in 1993 was typified by a mild wet winter with few frosts while 1994 was dry with many frosts through the winter months.

Table 1. Mean Minimum Temperatures and Rainfall for growing season 1993/94.

	MAY	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**TOTAL**
Av. Min Temp ^{0}C							
1993	7.7	3.3	5.7	3.3	5.9	9.3	
No. Frosts below -1.5 ^{0}C		2					**2**
1994	1.14	2.13	0.18	0.62	3	9	
No. Frosts below -1.5 ^{0}C	4	9	12	13	2	0	**28**
Rainfall mm							
1993	30	83	108	29	88	97	**435**
1994	0.4	18	6	8	5	21	**62**

Yield Limiting Factors

In 1993 the major yield limiting factor was the foliar disease powdery mildew (*Erisyphe pisi* Syd). In 1994, a number of factors contributed to the limitation of yield . The severity (as low as -6 ^{0}C) and frequency of frosts caused major tissue, and at earlier planting times plant, death. In conjunction with the frosts an outbreak of Bacterial Blight (*Pseudomonas syringae* pv. *pisi*), caused considerable damage. Outbreaks of Powdery Mildew later in the growing season also caused some yield loss.

There appeared to be little correlation between dry matter production at 30 days, 60 days and harvest maturity and grain yield.

Site mean grain yields in both years were greatest at the 25 May planting time regardless of leaf type, maturity type and plant height (fig. 1). Yields in 1993 for the 25 May planting were 80% higher than 1994 and for the 15 June plantings were 25% higher than those in 1994. It is considered that the milder, wetter growing season contributed to the higher yields in 1993.

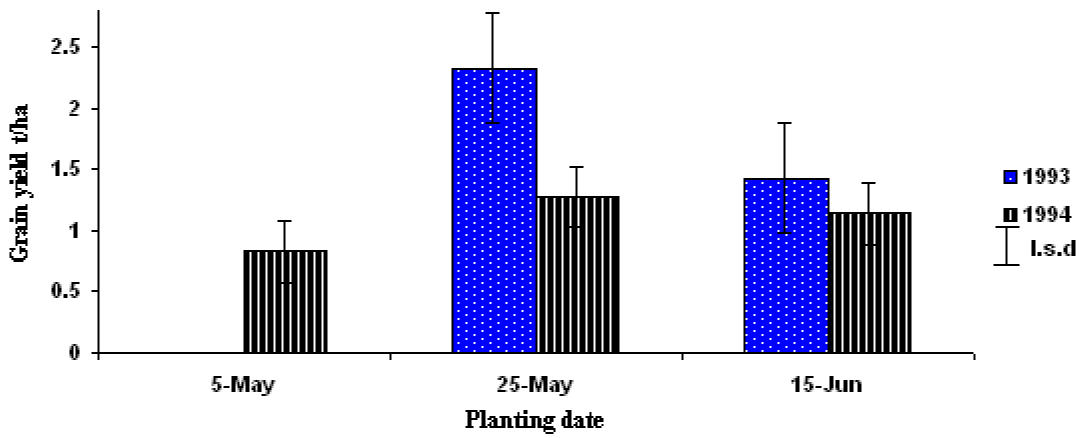

Figure 1. Site mean yield for selected planting dates

Mean Grain yields of various plant types across maturity groups indicated that at all times of planting in both years the semileafless types out-yielded both the conventional and tare types (fig. 2). The exception was at the 15 June planting time in 1994 where there was little yield difference between the three plant types used in the experiments. It is considered that yield potential in this case was limited by a severe late frost (-3 ^{0}C, 28 September) during flowering and pod set and the onset of high temperatures (30-35 ^{0}C) in early October.

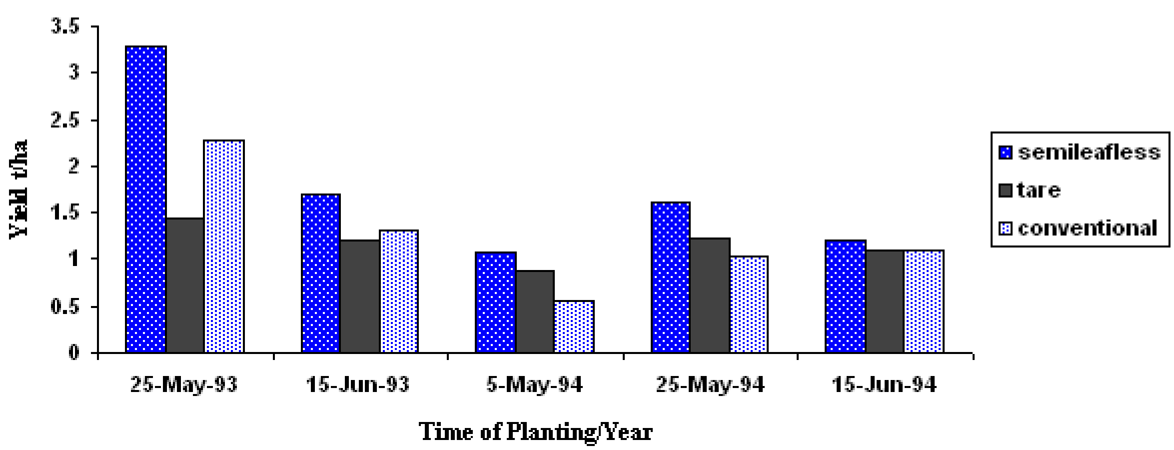

Figure 2. Mean yield of different plant types

It appears that the yield advantage of the semileafless plant type is a result of several factors, viz., the ability of the type to remain erect for longer during the growing season, the open nature of the canopy (which reduces the effect of the microclimate on the incidence of powdery mildew) and the more determinate nature of the type. Whilst the semileafless type appears to be more successful of the cultivars evaluated so far at Narrabri the maturity range of the material has been restricted to early/mid maturity types (80-85 days to flowering). There appears to be some yield differences between different maturity groups amongst the conventional material evaluated which would suggest that timing of and duration of flowering is also of considerable importance (fig. 3).

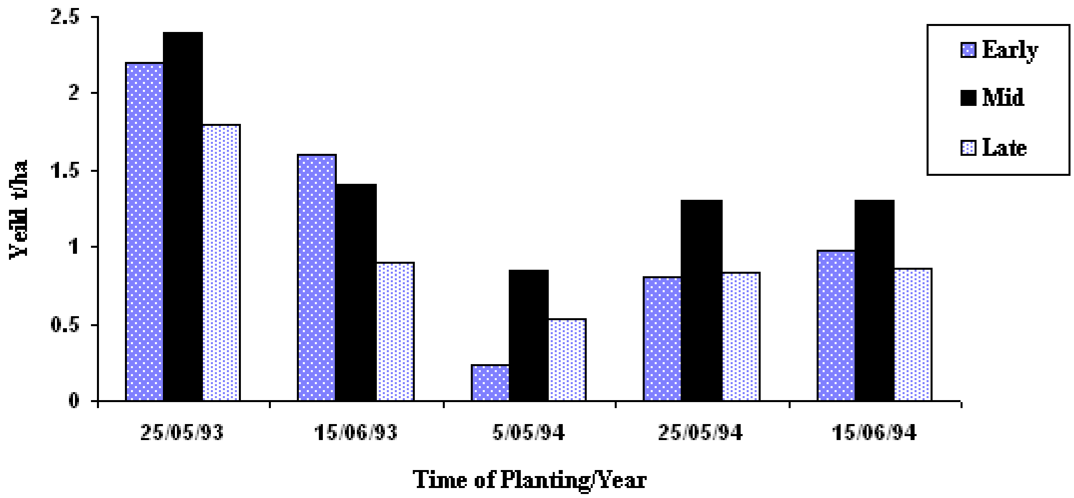

Figure 3. Mean yield conventional type

CONCLUSIONS

The importance of matching the phenology of the field pea to the environment appears to be vital in ensuring the success of this pulse species in the northern cropping belt; in particular, timing and duration of flowering. Of the material evaluated to date it would appear that semileafless types planted at mid to late May offer the best chance of maximising grain yields. An expanded evaluation program of breeding lines from all the field pea breeding programs is currently being undertaken.

ACKNOWLEDGMENTS

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