PBA Nasma(Ф) faba bean – effect of seed size at sowing on grain yield

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Key findings

At present, there is inconsistent evidence to suggest that seed size at sowing can affect grain yield in the faba bean cultivar PBA Nasma(Ф), with a positive yield benefit associated with sowing larger seed at Trangie, but no significant yield effect at Tamworth in 2015.

Seed size at sowing appears to be positively related to seed size at harvest.

Further experimentation is required.

Introduction

In cereals, large initial seed size frequently confers distinct advantages in terms of seedling vigour, hardiness, improved stand establishment, and higher productivity (Grieve & Francois, 1992). Spilde (1988) found for barley and wheat that grain produced from small-sized seed averaged 4% and 5% less yield than that from medium sized seed and 6% and 8% less yield than that from large-sized seed, respectively.

However, studies comparing faba bean genotypes of different seed sizes indicated a negative relationship between seed mass and grain yield (Laing et al., 1984; White & González, 1990; White et al., 1992; Sexton et al., 1994). Lima et al. (2005) found faba bean plants originating from small seed presented a higher relative growth rate and net assimilation rate than plants from large seed. Large seed did not affect grain yield, but reduced the number of seeds per pod, increased the 100 seed mass, and reduced the harvest index.

The new faba bean cultivar, PBA Nasma(Ф), produces very large seed averaging 70 g/100 seeds compared with cultivar Doza(Ф), at 50 g/100 seeds. An experiment was conducted to examine the effect of seed size at sowing, at a fixed population, on grain yield and seed size distribution at harvest.

Site details

This experiment was conducted at Tamworth (TAI) and Trangie (TARC). Experiments were sown on 23 April 2015 and 5 May 2015 at TAI and TARC, respectively. Both sites had 50 kg/ha of Granulock Z extra applied at sowing in furrow. Sites were harvested on 15 October 2015 and 27 October 2015 at TAI and TARC, respectively.

Treatments

Seed for this newly released cultivar, PBA Nasma(Ф), was in limited supply, which restricted experimentation to two sites; TAI and TARC in 2015.

The seed was passed through a set of nested circular mesh sieves and partitioned into four seed size categories; <7 mm, 7–8 mm, 8–9 mm and >9 mm with corresponding 100 seed weights of 34.6, 48.1, 69.5 and 90.0 g, respectively.

Randomised complete block experiments consisting of the four seed size treatments and four replicates were sown at target plant densities of 20 plants/m^2 at TAI and 10 plants/m^2 at TARC.

Results

The seed size distribution of the 25 kg seed lot used to obtain the seed categories for sowing these experiments is outlined in Figure 1. The predominant seed size was in the 8–9 mm category, which accounted for 72% of the total seed supply.

All plots attained their target plant densities (data not shown). At TAI, plants grown from the largest size seed produced 19% and 8% more biomass than the small seed size category when measured at 25 June and 3 August, respectively. Biomass loads were not measured at TARC. At TAI, plants from the different seed size categories were scored for frost damage on 7 August, but there was no significant difference between the seed size categories (data not shown).

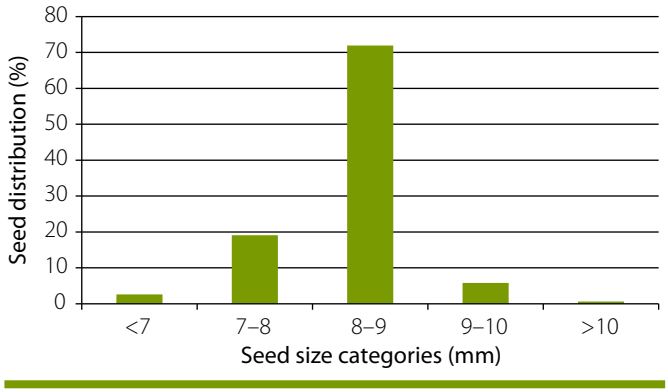

Figure 1. *Seed size distribution per category for PBA Nasma(Φ)*

At TAI, the plants grown from <7 mm seed were significantly shorter than all other seed categories, while there was no difference in height to top pod across the seed categories (Table 1). There was also no significant difference in grain yield between any of the seed size categories. Hundred seed weight did vary significantly with the large seed category (>9 mm), on average, producing heavier grain than the small seed category (<7 mm).

At TARC, grain yield was significantly higher (13%) for the two large seed size categories compared with the very small seed category. Hundred seed weight at harvest was similar to seed size category at sowing as found at TAI with 100 seed weight generally increasing with larger sown seed size (Table 1).

Table 1. *Effect of seed size category at sowing on plant height, height to top pod, grain yield and hundred seed weight for TAI and grain yield and hundred seed weight for TARC in 2015*

Seed size category	Tamworth (TAI)				Trangie (TARC)	
	Plant height (mm)	Height to top pod (mm)	Yield (kg/ha)	100 seed weight (g)	Yield (kg/ha)	100 seed weight (g)
<7 mm	1240 b	1000 a	3287 a	55.8 c	1696 c	48.1 d
7–8 mm	1358 a	1124 a	3144 a	65.0 ab	1726 bc	50.9 c
8–9 mm	1329 a	1030 a	3267 a	59.4 bc	1921 ab	55.2 b
>9 mm	1376 a	1078 a	3557 a	68.8 a	2013 a	60.0 a
Values with the same letter are not significantly different at P <0.05						

Summary

Plants grown from large seeds were taller and had significantly more biomass than the plants grown from small seed. However, this did not translate into a significant difference in grain yield at TAI, but did in the TARC experiment. There could be an interaction between plant density and seed size given these different results (TAI targeted 20 plants/m^2 while TARC only targeted 10 plants/m^2). These results are similar to that of Agung and McDonald (1998) in South Australia, where yields for cultivar Fiord averaged about 4000 kg/ha, but were not consistently related to seed size, although the highest yielding faba bean varieties at their sites were large seeded.

The size of seed produced at harvest was positively related to seed size at sowing. The largest seed category at sowing produced the biggest size seed at harvest, while conversely the smallest seed category at sowing produced the littlest size seed at harvest at both experimental sites in 2015 (Table 1).

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