INFLUENCE OF SEED VIGOUR ON CROP GROWTH AND YIELD OF BSH-1 HYBRID SUNFLOWER UNDER NORMAL AND COMPENSATED SEED RATES

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SUMMARY

Under natural storage conditions, loss of seed vigour is a common phenomenon. Seed vigour is considered to be one of the major factor which decides the crop performance. Studies on crop performance in relation to the seedling vigour are limited. A field study was therefore conducted at G.K.V.K. Farm, Bangalore during summer season using naturally aged seed lots of BSH-1 hybrid sunflower to study the effect of seed vigour on crop growth and yield with and without compensating the seed rate. Five seed lots widely differing in vigour (90, 86, 75, 68 and 50% germination, respectively) were used in the study. The seed rate of medium (V_2 and V_3) and low (V_4 and V_5) vigoured seeds were compensated to the level of high vigoured seeds (V_1). The results indicated that field emergence per cent linearly decreased with decreasing vigour level. However, the differences between high and medium vigour were not substantial. The differences in plant height among vigour levels however diminished as the plants progressed from juvenile to the reproductive phase. Days to half bloom, head diameter and seed yield per plant were not affected by vigour levels. Linear reduction in crop productivity was observed with decreased vigour levels. The maximum yield was recorded with high vigour level V_1 (24441 kg ha^{-1}) closely followed by V_2 (2387 kg ha^{-1}). An yield reduction of 12, 15 and 30 per cent were observed in V_3, V_4 and V_5 vigour levels due to reduced plant stand.

Seed rate compensation did not affect the growth parameters such as plant height, days to half bloom and head diameter but produced higher plant stand per unit area leading to higher grain yield (2258 kg ha^{-1}) than the normal seed rate (2040 kg ha^{-1}). However, maximum yield was observed with high vigoured seeds with normal seed rate (2445 kg ha^{-1}). The yield levels were normal with compensated seed rate upto V_4 vigour level with germination (68%) nearing seed certification level, below which the seed compensation did not improve the yield to the level of high vigoured seeds. Thus, the study inferred that it is possible to realize normal crop yield through maintenance of optimum plant population by compensating the seed rate of low vigoured seeds having germination upto 68 per cent, with no considerable effect of seed vigour on crop performance of BSH-1 hybrid sunflower.

INTRODUCTION

Sunflower being an oil seed losses its vigour and viability quickly due to increased rate of deterioration in storage. Reduction in vigour and germinability may or may not affect the yield performance. There are many instances in Karnataka and elsewhere that the validated seed lots of sunflower often failed to give satisfactory field stand, which was a consequence of reduced seed vigour. Loss of viability and vigour in seeds can affect the crop yield in two ways. Firstly, a decline in seed vigour leading to sub-optimal plant population and secondly use of low vigoured seeds may result in poor performance of the surviving plant (Gelmond *et al.*, 1978). Substantial loss of yield was reported in peas, beans, barley and onion only when considerable loss of germination was recorded in the seeds (Abdulla and Roberts, 1969). In groundnut reduction in yield was observed when seed germination declined below 63 per cent in spite of compensating the seed rate (Manjunath, 1993). On the contrary, Egli and Tekrony (1978), Amaral and Dos (1979) observed no marked difference in final yield due to seed vigour. Therefore, a field study was conducted to study the effect of seed vigour in naturally aged BSH-1 hybrid sunflower seed lots on field performance at Bangalore.

MATERIAL AND METHODS

Naturally aged seed lots of eleven months old widely differing in per cent germination were obtained from Karnataka State Seeds Corporation. Five seed lots (V_1 to V_5) widely differing in vigour (90, 86, 75, 68 and 50% germination, respectively) were used in this study. Based on germination percentage seed rate of medium (V_2 and V_3) and low (V_4 and V_5) vigoured seeds were compensated to a germination level of high vigoured seed (V_1). Field experiment with five treatments (V_1 - V_5) was laid out during summer season in RCBD design replicated four times. Two seeds sown 30 cm part in 60 cm rows. Thinning was done on 18 days after sowing. Recommended cultural and crop management practices were adopted uniformly for all the treatments.

The observation on field emergence, plant population, crop growth and yield parameters were made on ten randomly selected plants.

RESULTS AND DISCUSSION

The results indicated that the per cent field emergence and plant population linearly decreased with decrease in the vigour level. High vigoured seeds (V_1) recorded highest plant population (38.8/plot) followed by V_2 (38.3/plot), V_3 (34.7/plot), V_4 (33.5/plot) and the lowest was observed in V_5 (27.8/plot) vigour level seeds. However, the differences between high and medium vigour levels were not substantial. The initial differences in plant height among vigour levels however diminished as the plants progressed from the juvenile to the reproductive phase. The reduction in field emergence and plant population due to reduced seed vigour was also observed by many workers (Aswathaiah *et al.*, 1990; Alizag *et al.*, 1987). Days to 50 per cent flowering, head diameter and seed yield per plant were not affected by vigour levels.

Linear reduction in seed yield per hectare was obtained with decreased vigour levels. The maximum yield was recorded in high vigour level V_1 (2441 kg ha^{-1}) with the initial germination of 90 per cent which was on par with V_2 (2387 kg ha^{-1}) but both V_1 and V_2 produced substantially higher yield than other vigour levels. However, a yield reduction of 12, 15 and 30 per cent were observed in V_3, V_4 and V_5, respectively due to reduced plant stand. Similar association between vigour level and reduced plant density and yield has been reported by earlier workers (Jones and Gamble, 1984; Seshu *et al.*, 1988).

Compensated seed rate did not affect the growth parameters such as plant height, days to 50 per cent flowering and head diameter, but produced higher plant stand per unit area and grain yield (2258 kg ha^{-1}) than the normal seed rate (2040 kg ha^{-1}). However high vigoured seed (V_1) with normal seed rate produced maximum yield per ha (2445 kg ha^{-1}). The increased yield in compensated seed rate was mainly due to increased plant density, which clearly indicates a direct relationship between plant population and yield. Manjunath (1993) also observed a similar relation in groundnut. The results also give a clear indication that the yields were normal when compensated the seed rate up to V_4 vigour level with germination (68%) nearing seed certification level, beyond which the seed compensation did not improve the yield. Thus, the study inferred that it is possible to realize normal crop yield through maintenance of optimum plant population by compensating the seed rate of low vigoured seeds having germination percentage of 68 per cent and above in BSH-1 hybrid sunflower.

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Table 1. Field emergence, plant population and days to 50 per cent flowering as influenced by vigour levels and seed rates in BSH-1 hybrid sunflower.

Vigour levels	Field emergence (%)			Plant population (Net plot)			Days to 50% flowering		
	NSR	CSR	Mean	NSR	CSR	Mean	NSR	CSR	Mean
V_1 (90)	62.5	63.0	62.7	39.0	38.7	38.8	50.0	55.0	55.0
V_2 (86)	59.7	60.5	60.1	38.0	39.0	38.5	55.3	55.7	55.5
V_3 (75)	53.2	50.9	52.0	32.0	37.3	34.7	55.3	55.3	55.3
V_4 (68)	40.7	40.6	40.6	31.0	36.3	33.5	57.0	57.7	57.3
V_5 (50)	21.5	20.9	21.2	24.0	31.7	27.8	58.0	56.7	57.3
Mean	47.5	47.2	47.3	32.8	36.0	34.7	56.1	56.1	56.1
	SEm±	CD (0.05 P)		SEm±	CD (0.05 P)		SEm±	CD (0.05 P)	
Vigour (V)	1.95	5.80		2.14	6.30		0.42	1.27	
Seed rate (R)	1.23	NS		1.25	3.68		0.27	NS	
V x R	2.76	NS		3.12	NS		0.60	NS	
C.V. (%)		10.2			7.00			4.9	

Figures in the parenthesis are per cent germination
NSR = Normal seed rate; CSR = Compensated seed rate

Table 2. Head diameter, seed yield/plant and yield/ha as influenced by vigour levels and seed rates
in BSH-1 hybrid sunflower.

Vigour levels	Head diameter (cm)			Seed yield/plant (g)			Yield (kg/ha)		
	NSR	CSR	Mean	NSR	CSR	Mean	NSR	CSR	Mean
V_1 (90)	12.8	12.8	12.8	39.25	39.30	39.27	2445	2437	2441
V_2 (86)	12.5	12.6	12.5	38.92	38.72	38.82	2365	2409	2387
V_3 (75)	12.6	12.5	12.6	38.90	38.40	38.65	1988	2287	2137
V_4 (68)	11.9	12.2	12.1	38.80	38.18	38.53	1911	2224	2068
V_5 (50)	12.2	12.4	12.3	38.90	38.20	38.55	1493	1934	1713
Mean	12.4	12.5	12.4	38.97	38.56	38.76	2040	2258	2149
	SEm±	CD (0.05 P)		SEm±	CD (0.05 P)		SEm±	CD (0.05 P)	
Vigour (V)	0.51	NS		1.15	NS		56.0	166.0	
Seed rate (R)	0.32	NS		0.73	NS		35.4	105.2	
V x R	0.72	NS		1.63	NS		79.2	235.0	
C.V. (%)		11.50			7.30			6.40	

Figures in the parenthesis are per cent germination
NSR = Normal seed rate; CSR = Compensated seed rate