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Study on effect of surface seeding, seed rate and seed priming on yield of field pea under rice-based utera cropping system

Parvati Karkey, GK Shrivastava and DK Chandrakar

Abstract

The investigation entitled "Study on effect of surface seeding, seed rate and seed priming on yield of field pea under rice-based utera cropping system" was conducted at Research cum Instructional Farm, I.G.K.V, Raipur (C.G.). The main objective was to evaluate the effect of surface seeding, seed rate and seed priming on yield attributes of field pea taken as *utera* crop. The soil of the experimental field was vertisol with low, medium and high content of N, P and K, respectively and neutral in reaction. The test variety was Indira Matar-1. The experiment was laid out in Randomized Block Design having three replications and nine treatments *viz*. T_1: Dry surface seeding 80 kg ha^{-1}, T_2: Dry surface seeding 100 kg ha^{-1}, T_3: Dry surface seeding 120 kg ha^{-1}, T_4: Soaked seed surface seeding 80 kg ha^{-1}, T_5: Soaked seed surface seeding 100 kg ha^{-1}, T_6: Soaked seed surface seeding 120 kg ha^{-1}, T_7: Seed priming (1% KNO3) 80 kg ha^{-1}, T_8: Seed priming (1% KNO3) 100 kg ha^{-1} and T_9: Seed priming (1% KNO3) 120 kg ha^{-1}. The results revealed that treatment T_9: seed priming (1% KNO_3) 120 kg ha^{-1}, gave highest seed yield (1058 kg ha^{-1}) and stover yield (2290 kg ha^{-1}), but it remained at par with T_8: seed priming (1% KNO_3) 100 kg ha^{-1} and T_6: soaked seed surface seeding 120 kg ha^{-1}.

Keywords: Surface, rate and seed, rice-based, utera, system

Introduction

Field pea (*Pisum sativum* L.) also referred to as 'matar' in Hindi is one of the important pulse crops of the leguminaceae family. Field pea is an annual cool season, self-pollinating, leguminous pulse crop that is widely consumed all around the world and is favored and well liked in human vegetarian diets. Protein content in peas (21.2-32.9%), starch (36.9-49.0%), amylose (20.7-33.7%), total dietary fibre (14-26%), insoluble fibre (10-15%), soluble fibre (2-9%) and soluble sugars (5.3-8.7%) (Wendy, 2012). These nutritional characteristics make field peas one of the best feeds for animals and are almost indispensable for the effective and economical feeding of livestock. In Chhattisgarh, field pea is grown in an area of 0.011 million hectares with production and productivity of 0.004 million tonnes and 384 kg ha^{-1}, respectively (Indiastat, 2018-19). In Chhattisgarh, pulse crops like field pea are grown as utera crop under rainfed conditions where the crop germinates before the harvest of rice utilizing the residual moisture. Utera or paira cropping (relay cropping) is age old double cropping system under the rainfed conditions in which succeeding utera crop is directly sown in the standing rice crop after the flowering stage (Sharma *et al*., 2004) [14].

Under rainfed conditions inconsistent plant population, poor plant stand, impeded growth and low productivity are the key issues of field pea production in rice-based relay or utera copping system due to poor germination owing to shortage of optimum soil moisture content and improper interaction of seeds with moist soil. By expanding area under field pea or maximizing yield unit^{-1} area by implementing adequate production technologies with the use of optimum seed rate and proper management practices, it can be accomplished to satisfy the potential demand of nutrient for growing population. Seeding rate is the simplest management practice that can be used to vary plant populations and influence yields (Johnston *et al*. 2002) [8]. Rajput *et al.* (1989) [13] found that the highest grain yield was achieved by increasing the seed rate, while the low seed rate provided the minimum grain yield.

Seed priming has been commonly used to reduce the time between seed sowing and seedling emergence and to synchronize emergence. Heydecker (1973) [6] proposed the principle of seed priming. It is possible to improve the productivity of field pea in the rainfed area by seed priming. The most common seed priming methods used to improve seed germination and synchronization are halo priming (placing the seeds in a salt solution, KNO_3), hydro-priming (soaking the seeds in water), osmo-priming (immersion of the seeds in solutions with osmotic potential like PEG), matrix-priming (placing the seeds between saturated jute mat layers) and hardening (alternately soaking and drying the seeds) (Mc Donald, 2000 and Basra *et al*., 2002) [10, 3]. The simplest method of priming that can be done on the field itself is hydro-priming and halo-priming, and it is very advantageous for farmers. In recent years, the popularity of field pea as an utera crop has begun to grow. An effort has therefore been rendered to standardize the management practices for improving the productivity of field pea under rice-based utera cropping system.

Materials and Methods

The experiment "Study on effect of surface seeding, seed rate and seed priming on yield of field pea under rice-based utera cropping system" was conducted at Research cum Instructional Farm of IGKV, during *rabi* season of 2020-21. The climate of the region is sub-humid to semi-arid. The soil of the experimental field was vertisol with low, medium and high in N, P and K, respectively and neutral in reaction. The test variety was Indira Matar-1. The experiment was laid out in Randomized Block Design having three replications and nine treatments *viz*. T_1: Dry surface seeding 80 kg ha^{-1}, T_2: Dry surface seeding 100 kg ha^{-1}, T_3: Dry surface seeding 120 kg ha^{-1}, T_4: Soaked seed surface seeding 80 kg ha^{-1}, T_5: Soaked seed surface seeding 100 kg ha^{-1}, T_6: Soaked seed surface seeding 120 kg ha^{-1}, T_7: Seed priming (1% KNO3) 80 kg ha^{-1}, T_8: Seed priming (1% KNO3) 100 kg ha^{-1} and T_9: Seed priming (1% KNO3) 120 kg ha^{-1}.

Results and Discussion

Seed yield (kg ha^{-1})

The results showed that highest seed yield (1058 kg ha^{-1}) was obtained under T_9: Seed priming (1% KNO_3) 120 kg ha^{-1}. It was found to be at par with T_6: Soaked seed surface seeding 120 kg ha^{-1} (1021 kg ha^{-1}) and T_8: Seed priming (1% KNO_3) 100 kg ha^{-1} (1045 kg ha^{-1}). Whereas, the lowest seed yield (577 kg ha^{-1}) was obtained under T_1: Dry surface seeding 80 kg ha^{-1}. In utera cropping plant population plays a major role in determining the yield. More plant population ultimately gives greater seed yield and seed priming attributed to improvement in growth parameters like plant height, dry matter accumulation and number of nodules which resulted in better utilization of solar energy which led to increased synthesis of carbohydrates, consequently resulting in increase in seed yield. The result thus observed was in accordance with Pakbaz *et al.* (2014) [12], it was reported that the seed yield was significantly superior in KNO_3 primed seeds as compared to other treatments. Koeshall *et al*. (2020) [9] reported that higher seeding rates tends to increase yield, even though some yield parameters are reduced. Gan *et al*. (2003) [5] also reported that the seed yield of dry pea increased with increasing plant population density (PPD).

Stover yield (kg ha^{-1})

The results showed that highest stover yield (2290 kg ha^{-1}) was obtained under T_9: Seed priming (1% KNO_3) 120 kg ha^{-1}. It was found to be at par with T_6: Soaked seed surface seeding 120 kg ha^{-1} (2208 kg ha^{-1}) and T_8: Seed priming (1% KNO_3) 100 kg ha^{-1} (2229 kg ha^{-1}). Whereas, lowest stover yield (1214 kg ha^{-1}) was obtained under T_1: Dry surface seeding 80 kg ha^{-1}. The highest stover yield was mainly due to accumulation of higher dry matter, more number of branches $plant^{-1}$ and more plant height. This may be due to positive correlation between plant height and stover yield. These findings were similar to Pakbaz *et al.* (2014) and Agawane and Parhe (2015) [12, 1], they reported that the stover yield was significantly maximum in KNO_3 primed seeds as compared to other treatments. Dahmardeh *et al*. (2010) [4] in fababean reported that increasing plant density lead to increase in biological yield.

Harvest index

Non-significant variations were observed in harvest index due to surface seeding, seed rate and seed priming. However, among the various treatments, T_1: Dry surface seeding 80 kg ha^{-1} recorded the maximum harvest index (32.17%). The lowest harvest index (31.36%) was noted under T_3: Dry surface seeding 120 kg ha^{-1}. The findings were in accordance with Mehri (2015) and also Jan *et al*. (2000) [11] reported progressive decrease in harvest index with increasing seed rates.

Table 1: Seed yield, Stover yield and harvest index of field pea as influenced by surface seeding, seed rate and seed priming

Treatment	Seed Yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
T_1- Dry surface seeding 80 kg ha^{-1}	577	1214	32.17
T_2- Dry surface seeding 100 kg ha^{-1}	678	1457	31.71
T_3- Dry surface seeding 120 kg ha^{-1}	782	1708	31.36
T_4- Soaked seed surface seeding 80 kg ha^{-1}	642	1357	32.09
T_5- Soaked seed surface seeding 100 kg ha^{-1}	853	1824	31.83
T_6- Soaked seed surface seeding 120 kg ha^{-1}	1021	2208	31.60
T_7- Seed priming (1% KNO_3) 80 kg ha^{-1}	748	1580	32.14
T_8- Seed priming (1% KNO_3) 100 kg ha^{-1}	1045	2229	31.91
T_9- Seed priming (1% KNO_3) 120 kg ha^{-1}	1058	2290	31.60
SEm ±	50	84	0.53
CD (P= 0.05)	150	251	NS

Conclusion

Seed priming (1% KNO_3) with 120 kg seeds ha^{-1}, produced the highest seed yield (1058 kg ha^{-1}) and stover yield (2290 kg ha^{-1}) followed by seed priming (1% KNO_3) with 100 kg seeds ha^{-1} and soaked seed surface seeding with 120 kg seeds ha^{-1}. Whereas lowest seed yield and stover yield was obtained under dry surface seeding 80 kg ha^{-1} (577 and 1214 kg ha^{-1} respectively). It was registered that the percent increment in the seed yield was to the tune of 83.4, 81.6 and 76.9 over dry surface seeding 80 kg ha^{-1}.

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