The results of present investigation entitled “Response of rajmah (Phaseolus vulgaris L.) to spacing and fertility levels” reported in previous chapter showed many significant variations due to spacing and fertility levels. In this chapter it is contemplated to discuss those variations assigning suitable reasons and supporting relevant references for the treatment effects. For the sake of convenience the entire chapter has been divided into the following heads.

5.1 Effect of soil and weather

5.2 Effect of spacing

5.3 Effect of fertility levels

5.4 Interaction effect

5.5 Economics

5.1 Effect of soil and weather

The crop growth and development is largely influenced by the soil, available moisture, nutrients and certain weather parameters. The data presented in Table 3.2 revealed that the soil of experimental site was clayey in texture, rich in organic carbon, medium in available nitrogen, P$_2$O$_5$ and K$_2$O and alkaline in reaction with pH of 7.9. So, the soil was found suitable for satisfactory growth and development of the rajmah crop.

The meteorological data furnished in Table 3.1 and graphically depicted in Fig. 3.1 revealed that all the meteorological parameters were congenial for the satisfactory growth and development of rajmah during rabi season of 2015-16. The crop was kept weed free by inter cultivation and hand weeding at appropriate time. Further all the observations were recorded timely without any failure to get the fine results. Thus, whatever the variations observed in the investigation are likely attributed to different treatments exercised in the experiment.
5.2 Effect of spacing

5.2.1 Effect of spacing on growth parameters

Significant effect of spacing on initial and final population was recorded. Increases in each inter row spacing from 30 to 60cm reduced plant population significantly (Table 4.1). Increase or decrease in plant population per unit area is a direct effect of the adopted inter and intra row spacing. Thus, plant population per unit area was higher in closer row spacing over wider spacing. The results are substantiated by the studies conducted by Tuarira and Moses (2014).

Plant height at 60DAS and at harvest (Table 4.2) recorded significantly higher when crop was sown at closer row spacing of 30cm x 10cm as compared to wider row spacing viz., 60cm x 10cm and 45cm x 10cm. The taller plants fond under closer row spacing of 30cm x 10cm, which were 28.6 and 16.0 per cent at 60DAS and 20.3 and 6.8 per cent at harvest, respectively higher as compared to wider row spacing of 60cm x 10cm and 45cm x 10cm, respectively. This might be due to higher competition under narrow spacing for space and light with rapid meristematic activity and increase in size of cell which ultimately increases in plant height. However, under wider spacing produced lower plant height due to less competition for space and light which might be increased plant spread. The increase in plant height under closer spacing is consistent with the studies carried out on legumes indicate that legumes respond to shading and density stress by etiolation (Harper, 1977). Etiolation is mostly caused by competition for light among plants. When plants are sown at closer spacing their stems are shaded from light resulting in accumulation of auxin which is a major growth hormone that stimulates cell division and enlargement (Weaver, 1972). In sparsely spaced plants, auxin destruction by light occurs resulting in plants being shorter. These results are conformity with, Ahlawat (1996), Dhanjal et al. (2001), Pawar et al. (2007), Chakravorty et al. (2009), Kazemi et al. (2012) and Yehia et al(2016).

Effect of row spacing on number of leaves plant^{-1} was found significant (Table 4.3). Rajmah sown at wider row spacing of 60cm x 10cm and 45cm x 10cm were at par and recorded remarkably higher number of leaves plant^{-1} than closer spacing of 30cm x 10cm. The per cent increase in number of leaves plant^{-1} due to wider row spacing of 60cm x 10cm were 29.8 per cent at 30 DAS over closer spacing
of 30cm x 10cm. Rajmah sown at 60cm x 10cm spacing produced significantly more number of leaves these might be due to lesser inter row competition for light and have adequate space to extend its leaf and intercept more light with less competition. The results obtained in present study are in close agreement with those reported by, Chakravorty et al. (2009), Amer et al. (2012), Mureithi et al. (2012) and Woldesenbet (2014).

Number of branches plant$^{-1}$ was significantly influenced due to row spacing (Table 4.3). Sowing of rajmah at wider spacing of 60cm x 10cm and 45cm x 10cm were at par and recorded significantly higher number of branches plant$^{-1}$ than closer spacing of 30cm x 10cm. The per cent increase in number of branches plant$^{-1}$ due to wider row spacing of 60cm x 10cm were 15.9 per cent at 60DAS and 17.3 per cent at harvest, respectively over closer spacing of 30cm x 10cm. Wider row spacing provided more space around each plant resulting in more metabolic activities through better utilization of light, space, water and nutrients which might be turned in better vegetative growth in term of number of branches plant$^{-1}$. Dense population under closer row spacing reduced number of branches plant$^{-1}$ might be due to less availability of space for each plant which increased competition among the plants for resources. Chakravorty et al. (2009) also reported that wider sowing gave more space to individual plants for branching than closely sown plants. The results corroborates with the findings of Das et al. (1996), Pawar et al. (2007), Abate et al. (2012), Kazemi et al. (2012), Mureithi et al. (2012), Getachew (2014) and Tuarira and Moses (2014).

Dry matter accumulation at 30 and 60DAS and at harvest significantly affected due to different row spacing (Table 4.4). Rajmah crop was sown at wider row spacing of 60cm x 10cm and 45cm x 10cm were at par with each other except at 30DAS and recorded significantly higher dry matter accumulation plant$^{-1}$ than closer row spacing of 30cm x 10cm. The per cent increase in dry matter accumulation due to wider row spacing of 60cm x 10cm were 25.7, 20.0 per cent at 30 and 60DAS and 38.7 per cent at harvest, respectively over closer spacing of 30cm x 10cm. Wider row spacing provided more space around each plant resulting in more metabolic activities through better utilization of light, space, water and nutrients which might be turned in better vegetative growth in term of dry matter production per plant. Dense population
under closer plant geometry reduced dry matter production might be due to less availability of space for each plant which increased competition among the plants for resources. The results corroborates with the findings of Mureithi et al. (2012), Ayoub and Abdalla (2014) and Yehia et al. (2016).

Significant effect of spacing on days to maturity was observed (Table 4.5). Wider sown crop takes more days to maturity as compared to narrow spaced crop.

However, non-significant differences in days to 50% flowering due to different row spacing (Table 4.5). This might be due to the supportive effects of more available fertilizers to lower number of plants per unit area which permitted building of more vigorous growth that resulted in higher number of days for flowering and maturity. Results confirm the findings of Samih Abubaker (2008).

**5.2.2 Effect of spacing on yield attributes and yield**

A remarkable increasing trend in case of number of pods plant\(^{-1}\), length of pod and number of seeds pod\(^{-1}\) (Table 4.6) were observed with increase in row spacing. Significantly more number of pods, length of pod and number of seeds pod\(^{-1}\) were observed when crop was sown at wider row spacing of 60cm x 10cm and remained comparable with row spacing of 45cm x 10cm than closer row spacing of 30cm x 10cm. Per cent increase in number of pods plant\(^{-1}\), length of pod and number of seeds pod\(^{-1}\) under wider row spacing of 60cm x 10cm over closer row spacing of 30cm x 10cm were to the tune of 25.2, 27.5 and 25.0 per cent, respectively. Thus, more space available to individual plants under wider row spacing might have increased utilization of natural resources particularly space, nutrients, moisture, CO\(_2\) and radiant energy ultimately increase in production of photosynthate which resulted in longer pod and more number of pods with more seeds pod\(^{-1}\). Limited allocation of space under narrow row spacing causing more competition for resources might be resulted in poor vegetative and reproductive growth. Significantly more number of seeds pod\(^{-1}\) and seeds plant\(^{-1}\) at wider row spacing reported by (Pawar et al. 2007) in case of pod plan\(^{-1}\), pod length and seeds pod\(^{-1}\), number of pods plant\(^{-1}\) (Chakravorty et al., 2009), pod length and seeds pod\(^{-1}\) were maximum under wider row spacing Koli and Akashe (1995), Abate et al.(2012), Kazemi et al. (2012), Ayoub and Abdalla (2014) and Getachew et al. (2014) in case of pods plant\(^{-1}\), Tuarira and Moses (2014) also reported more pods plant\(^{-1}\) under wider row spacing.
The data presented in Table 4.9 revealed that seed and stover yields were significantly affected due to different row spacing. Rajmah crop sown at closer spacing of 30cm x 10cm produced significantly higher seed yield of 1264 kg ha⁻¹ and it was at par with row spacing of 45cm x 10cm than crop sown at 60cm x 10cm. The magnitude of increase in seed yield under 30cm x 10cm was 33.7 and 21.5 per cent over 60cm x 10cm and 45cm x 10cm, respectively. Higher seed yield under 30cm x 10cm row spacing proved conspicuously superior to the other row spacing treatments. The higher values of yield attributes recorded under widely spaced plant (Table 4.6) did not exert their influence on yield obtained under narrow spacing. The difference in plant population (Table 4.1) not compensated by increasing yield attributes in wider row spacing. Higher seed yield with 30cm x 10cm plant spacing might be due to closer spacing accommodates more number of stover of plants per unit area and might contributes cumulative towards more yield than wider spaced plant. Significantly higher seed and stover yields under narrow spacing of 30cm x 10cm was mainly attributed to the fact that this spacing acquired 96.8 per cent higher plant population than 60cm x 10cm. The findings are in close conformity with the results reported by Nadal and Moreno (2006), Pawar et al. (2007), Samih Abubaker (2008), Chakravorty et al. (2009), Ayoub and Abdalla (2014), Getachew et al. (2014), Woldesenbet (2014), Tuarira and Moses (2014), Kalita et al. (2016) and Yehia et al. (2016).

Similar to seed yield, significantly higher stover yield of 1632 kg ha⁻¹ was recorded when crop was sown at closer row spacing of 30cm x 10cm (Table 4.9). The increase in stover yield under 30cm x 10cm over 60cm x 10cm and 45cm x 10cm was to the tune of 33.3 and 18.0 per cent. Higher stover yield under narrow spacing of 30cm x 10cm proved conspicuously superior to other row spacing. The higher values of plant height recorded under narrow spacing (Table 4.2) and higher values of growth parameters recorded under widely sown crop (Table 4.3 and Table 4.4) did not exert their influence on stover yield obtained under narrow spacing. Significantly higher plant population under narrow spacing (Table 4.1) could not be compensated by increasing growth parameters in wider sown crop. Significantly higher stover yield of rajmah under closer row spacing also reported by Pawar et al. (2007).

The harvest index was however not significantly influenced by different row spacing (Table 4.12). This might have been due to absence of variation in the
difference in seed and stover yields under different row spacing treatments. Kazemi et al. (2012) also observed non-significant effect of row spacing on harvest index.

### 5.2.3 Effect of row spacing on quality parameters

Quality parameters like 100-seed weight was not affected significantly due to row spacing (Table 4.12) while, protein content and protein yield were significantly influenced by row spacing (Table 4.12). These results are in accordance with the finding of Samih Abubaker (2008) and Yehia et al. (2016).

### 5.2.4 Effect of row spacing on nutrient content and uptake

Different row spacing exerts their significant influence on nitrogen in stover and phosphorus content in seed and stover (Table 4.15). Significantly maximum nitrogen content in stover 1.92% and phosphorus content in seed (0.86%) and stover (0.50%) were observed when crop was sown at wider row spacing of 60cm x 10cm. The results obtained in present study are in close agreement with those reported by Samih Abubaker (2008) and Yehia et al. (2016).

### 5.2.5 Effect of spacing on soil nutrient status after harvest of crop

Soil fertility status after harvest of rajmah was not significantly influenced due to different row spacing (Table 4.22). After harvest of crop available soil nutrients viz., nitrogen, phosphorus and potash were slightly increased by litter fall and root exudates but cannot reach the levels of significant due to the losses of decomposed materials and immobilization with wider C: N ratio.

### 5.3 Effect of fertility levels

#### 5.3.1 Effect of fertility levels on growth parameters

The data presented in Table 4.1 revealed that initial and final plant population was not significantly influenced due to different fertility levels. This indicated that application of different levels of nitrogen and phosphorus had no influence on germination and emergence which tended to indicate that plant population was uniform in all the fertility levels and there was no adverse effect on rajmah crop. Zahida (2016) observed no significant effect of fertilizers on germination per cent in rajmah. Similar results were also reported by Sherawat and Singh (2009) and Sulieman et al. (2009).
Among the studied growth parameters, plant height (Table 4.2), number of leaves and branches plant$^{-1}$ (Table 4.3) and dry matter accumulation (Table 4.4) at 30, 60DAS and at harvest increased with increase in fertility levels from 00-00 NP kg ha$^{-1}$ to 100-60 NP kg ha$^{-1}$ except number of branches and dry matter accumulation plant$^{-1}$ at 30DAS. Significantly taller plant of 18.0, 26.0 and 30.9cm at 30, 60DAS and at harvest, respectively were found with the application of 100-60 NP kg ha$^{-1}$ which were 22.8, 26.2 and 21.2 per cent taller than control, accordingly. Similarly, number of leaves plant$^{-1}$ was recorded significantly maximum (19.9) when crop was fertilized with 100-60 NP kg ha$^{-1}$. Periodical branches plant$^{-1}$ (Table 4.3) was also recorded significantly higher with the application of 100-00 NP kg ha$^{-1}$ than control. The magnitude of increase in number of branches plant$^{-1}$ at 30, 60DAS and at harvest with the application of higher dose of 100-60 NP kg ha$^{-1}$ was to the tune of 12.1, 29.3 and 32.0 per cent, respectively over no fertilizer application. In case of dry matter accumulation (Table 4.4), significantly maximum dry matter of 7.3 and 11.0g at 60DAS and at harvest, respectively were recorded when rajmah was fertilized with 100-60 NP kg ha$^{-1}$. Corresponding values of increase in dry matter accumulation palnt$^{-1}$ under higher fertility level was to the tune of 17.3 and 30.0 per cent over control treatment. The increase in growth parameters like plant height, number of leaves, number of branches and dry matter accumulation with increase in fertility levels could be attributed to favourable effect of nitrogen in increasing cell wall material resulted in increased size of cell. It contributes to cell division and cell elongation. Also meristematic tissue has very active protein metabolism and photosynthetic transport to sites of growth which are used predominantly in synthesis of nucleic acid and protein. Phosphorus is another element constitute of cell nucleus and essential for cell division and development of meristem. Phosphorus play an important role in metabolism and it is structural element of certain co-enzymes like NADP, ATP and ADP which act as energy transfer currency and thus improves photosynthesis. These results are in accordance with the findings of Maske et al.(2009), Sherawat and Singh (2009), Singh and Chauhan (2009), Singh et al. (2009), Sen et al. (2010), Singh et al. (2011), Salehin and Raheman (2012), Dwivedi et al. (2013), Lad et al. (2014), Turuko and Mohammed (2014), Ali et al. (2015) Moghaddam and Aminpanah (2015), Shahid et al. (2015) and Zahida et al. (2016).
The results pertaining to days to 50% flowering and days to maturity (Table 4.5) indicated that different NP levels exert their significantly effect on days to 50% flowering and maturity. Maximum days for 50% flowering and maturity were taken when crop was fertilized with 100-60 NP kg ha\(^{-1}\). This might be due to adequate availability of nutrients to crop not suffer with nutrient stress this might be responsible for non-significant. Results are complete agreement with those of Singh et al. (2009).

5.3.2 Effect of fertility levels on yield attributes and yield

Significantly more number of pods plant\(^{-1}\), longer pod length and more number of seeds pod\(^{-1}\) (Table 4.6) were recorded when rajmah crop was fertilized with 100-60 NP kg ha\(^{-1}\). Application of 100-60 NP kg ha\(^{-1}\) remarkably increased number of pods plant\(^{-1}\) (12.0), length of pod (11.9cm) and number of seeds pod\(^{-1}\) (4.1) as compared to control treatment and it was comparable with 60-30 NP kg ha\(^{-1}\) and 80-40 NP kg ha\(^{-1}\) except number of seeds pod\(^{-1}\). The probable reason for increase in number of pods plant\(^{-1}\), length of pod and number of seeds pod\(^{-1}\) might be due to nitrogen which favourably influenced flowering and fruiting, phosphorus played key role in large number of enzyme reactions that depend upon phosphorylation. Phosphate is also constituent of phospholipids thus balanced amount of phosphorus with other nutrients improve bio-chemical processes in plant. Higher availability of phosphorus in soil results in higher phosphorus uptake by plant which ultimately resulted improvement in yield attributes. Begum et al. (2003) noted that higher fertilizer dose improves number of pods plant\(^{-1}\), pod length and number of seeds pod\(^{-1}\) significantly. Singh et al. (2003), Maske et al. (2009), Sherawat and Singh (2009), Singh et al. (2009), Sulieman et al. (2009), Sen et al. (2010), Shubhashree et al. (2011), Dwivedi et al. (2013), Lad et al. (2014), Ali et al. (2015), Shahid et al. (2015), Shanka et al. (2015) and Zahida et al. (2016).

The data furnished in Table 4.9 indicated that seed and stover yields were significantly influenced by different fertility levels. Application of 100-60 NP kg ha\(^{-1}\) to rajmah produced significantly higher seed and stover yields of 1202 and 1604 kg ha\(^{-1}\) and which was found at par with lower fertility level of 80-40 NP kg ha\(^{-1}\). The magnitude of increase in seed and stover yields over control were to the tune of 20.2 and 32.8 per cent, respectively. Thus, increasing trend as observed in seed and stover
Discussion

Yields were evidently due to cumulative effects of increasing trend observed on major growth parameters \( \text{vz.} \), plant height (Table 4.2), number of leaves plant\(^{-1} \), number of branches plant\(^{-1} \) (Table 4.3), dry matter accumulation (Table 4.4); yield attributes \( \text{vz.} \), number of pods plant\(^{-1} \), length of pod and number of seeds pod\(^{-1} \) (Table 4.6); seed and stover yields plant\(^{-1} \) (Table 4.9), numerically higher uptake of nitrogen (Table 4.17), phosphorus (Table 4.19) and potash (Table 4.21). Moreover, overall improvement in vegetative growth at higher fertility level, which favourably influenced flowering and fruiting which ultimately resulted in increased number of pods plant\(^{-1} \). Thus, application of 100-60 NP kg ha\(^{-1} \) was optimum dose for rajmah. The results confirms the findings of Begum \textit{et al.} (2003), Singh \textit{et al.} (2003), Maske \textit{et al.} (2009), Sherawat and Singh (2009), Singh \textit{et al.} (2009), Sen \textit{et al.} (2010), Shubhashree \textit{et al.} (2011), Singh \textit{et al.} (2011), Salehin and Rahman (2012), Dwivedi \textit{et al.} (2013), Lad \textit{et al.} (2014), Ali \textit{et al.} (2015) Kasinath and Ramakrishna (2015), Shahid \textit{et al.} (2015), Shanka \textit{et al.} (2015) and Zahida \textit{et al.} (2016).

Different fertility levels failed to exert their significant influence on harvest index (Table 4.12). These findings are corroborates the report of Lad \textit{et al.} (2014) and Zahida \textit{et al.} (2016).

5.3.3 Effect of fertility levels on quality parameters

Data presented in Table 4.12 showed that application of 100-60 NP kg ha\(^{-1} \) to rajmah recorded significantly higher values of 100-seed weight (29.0 g), protein content (23.30%) and protein yield (277 kg ha\(^{-1} \)). Per cent increase in test weight, protein content and protein yield under 100-60 NP kg ha\(^{-1} \) over control were to the tune of 19.3, 14.3 and 36.4\%, respectively. These results are in accordance with the finding of Singh \textit{et al.} (2003), Maske \textit{et al.} (2009), Sherawat and Singh (2009), Dwivedi \textit{et al.} (2013), Lad \textit{et al.} (2014) and Zahida \textit{et al.} (2016).

5.3.4 Effect of fertility levels on nutrient content and uptake

Various NP levels produced their significant effect on nitrogen and phosphorus content in seed and stover (Table 4.15), nitrogen, phosphorus and potash uptake by seed and stover (Table 4.17, Table 4.19 and Table 4.21). Rajmah fertilized with 100-60 NP kg ha\(^{-1} \) appreciably improved nitrogen content in seed (3.8\%) and stover (2.1\%); phosphorus content in seed (0.9\%) and stover (0.5\%), nitrogen uptake
Discussion

by seed (45.60 kg ha\(^{-1}\)) and stover (32.35 kg ha\(^{-1}\)), phosphorus uptake by seed (11.10 kg ha\(^{-1}\)), and stover (8.50 kg ha\(^{-1}\)) and potash uptake by seed (6.10 kg ha\(^{-1}\)), and stover (4.30 kg ha\(^{-1}\)). As stated in earlier paragraph that application of NP might have improve nutritional environment in rhizosphere as well as plant system leading to absorption, uptake and translocation of nutrient in reproductive structure which leads to higher content and uptake. Higher seed and stover yields with supply of nutrients might have increase nitrogen, phosphorus and potash content in seed and stover which reflected higher uptake of nitrogen, phosphorus and potash by plants. Similar findings were also reported by Singh et al. (2003), Sulieman et al. (2009), Shubhashree et al. (2011), Kasinath and Ramakrishna (2015), Moghaddam and Aminpanah (2015).

5.3.5 Effect of fertility levels on nutrient status after harvest of crop

Results on soil fertility status after harvest of rajmah crop as influenced by different fertility levels presented in Table 4.22 showed that available nitrogen and phosphorus were significantly influenced by different fertility levels and maximum available nitrogen of 326.1 kg ha\(^{-1}\) and phosphorus of 24.5 kg ha\(^{-1}\) were observed when crop was fertilized with 100-60 NP kg ha\(^{-1}\).

5.4 Interaction effect

Interaction effect between row spacing and fertility levels was found significant for pod length (Table 4.7), seeds pod\(^{-1}\) (Table 4.8), seed yield ha\(^{-1}\) (Table 4.10), stover yield ha\(^{-1}\) (Table 4.11), protein content and yield (Table 4.13 and 4.14), nitrogen uptake by seed (Table 4.18) and phosphorus uptake by stover (Table 4.20).

Sowing of rajmah at 60cm x 10cm and fertilizing the crop with 100-60 NP kg ha\(^{-1}\) noted maximum pod length of 14.6cm and it was remained at par with S\(_3\)F\(_2\). Similarly significantly maximum seeds pod\(^{-1}\) (4.53) were produced when crop was sown at 60cm x 10cm and fertilized with 100-60 NP kg ha\(^{-1}\) (S\(_3\)F\(_3\)) which closely followed by S\(_2\)F\(_3\) and S\(_1\)F\(_2\). In case of seed and stover yield, crop sown at closer spacing of 30cm x 10cm and fertilized with 100-60 NP kg ha\(^{-1}\)produced significantly maximum seed and stover yields of 1470 and 1972 kg ha\(^{-1}\), respectivelyand found statistically at par with treatment combination S\(_1\)F\(_2\) in seed yield andS\(_1\)F\(_2\) and S\(_2\)F\(_3\) in stover yield. Significantly maximum protein content of 24.4% was observed when crop was sown at wider row spacing of 60cm x 10cm and crop fertilized with 100-60
kg NP ha\(^{-1}\) which was remained on par with treatment combination \(S_2F_3\), \(S_2F_2\) and \(S_3F_2\). While maximum protein yield of 314 kg ha\(^{-1}\) was recorded when crop was sown at closer spacing of 30cm x 10cm and fertilized with 100-60 kg NP ha\(^{-1}\) which was closely followed by \(S_1F_2\), \(S_2F_3\) and \(S_2F_2\). Significantly maximum nitrogen uptake by seed (50.48 kg\(^{-1}\)) and phosphorus uptake by stover (9.87 kg ha\(^{-1}\)) were noted when crop was sown at 30cm x 10cm row spacing and fertilized with higher level of NP i.e. 100-60 kg ha\(^{-1}\)which were comparable with \(S_1F_2\), \(S_2F_2\) and \(S_2F_3\) in case of nitrogen uptake by seed and with \(S_2F_3\) in case of phosphorus uptake by stover. The results more or less collaborates the findings of Moniruzzaman et al. (2009).

5.5 Economics

Economics play an important role in deciding the adoption of a particular treatment by the farmers. The gross and net realization as well as B: C ratio were calculated for row spacing as well as for different fertility levels.

The economic evaluation of different treatments revealed that the gross and net realization with B: C ratio differed appreciably (Table 4.23). The maximum gross and net realization recorded \(\text{¥} \ 85,424 \text{ ha}^{-1}\), \(\text{¥} \ 57,542 \text{ ha}^{-1}\) with B: C ratio of 3.06, respectively, were obtained under spacing \(S_1\) (30cm x 10cm) followed by \(S_2\) (45cm x 10cm) with giving gross and net realization as well as B: C ratio of \(\text{¥} \ 77,510 \text{ ha}^{-1}\), \(\text{¥} \ 49,726.1 \text{ ha}^{-1}\) with B: C ratio of 2.89, accordingly. Data further showed that rajmah fertilized with 100-60 kg NP ha\(^{-1}\) (F\(_3\)) recorded maximum gross and net return \(\text{¥} \ 81,338 \text{ ha}^{-1}\), \(\text{¥} \ 50,010 \text{ ha}^{-1}\), respectively.

The data furnished in Table 4.24 revealed that maximum gross, net realization and B: C ratio with \(\text{¥} \ 99,494 \text{ ha}^{-1}\), \(\text{¥} \ 69,096 \text{ ha}^{-1}\) and 3.3, were obtained under treatment combination \(S_1F_3\) followed by \(S_1F_2\). These results on economics are in close vicinity with those obtained by Singh et al. (2003), Sen et al. (2010), Lad et al. (2014), Ali et al. (2015), Shahid et al. (2015), Shanka et al. (2015) and Kalita et al. (2016).