The Pharma Innovation Journal 2022; 11(2): 2506-2512

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277- 7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2022; 11(2): 2506-2512

www.thepharmajournal.com
Received: 09-11-2021
Accepted: 03-12-2021

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# Studies on growth and productivity of maize-cowpea intercropping system under different spatial arrangements and nutrient levels

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**Abstract**
The present investigation was carried out at during summer of 2019 and 2020 at College Farm, Navsari Agricultural University, Navsari (Gujarat) find out the effect of row arrangements and nutrient levels on growth and yield of maize and cowpea intercropping system. The experiment was conducted with the objective to determine the appropriate row arrangement, nutrient levels and the best combination of row arrangement and nutrient levels for maize-cowpea intercropping system. The experiment was laid-out in factorial randomized block design keeping five row arrangements and three nutrient levels with three replications. Treatments comprised of five row arrangements *viz.*, sole maize ($A_1$), sole cowpea ($A_2$), maize-cowpea (1:1) ($A_3$), maize-cowpea (1:2) ($A_4$) and maize-cowpea (2:1) and three nutrient levels *viz.*, 75% RDF ($F_1$), 100% RDF ($F_2$) and 125% RDF ($F_3$). Recommended dose of fertilizer used for maize and cowpea were 120:60:40 and 20:40:00 N:$P_2O_5$:$K_2O$ kg/ha respectively. Hybrid variety sugar 75 of maize and GC-6 of cowpea were taken as test crops during the investigation.
The results of the experiment showed that, growth parameters of maize *viz.*, plant height of maize was significantly influenced by crop arrangement and the highest values were recorded by sole maize. In respect of number of functional leaves, leaf area index (LAI) recorded by 1:2 row arrangement found significantly higher over the sole maize, 1:1 and 2:1 row arrangement. Among the nutrient levels all growth parameters *i.e.*, plant height, number of functional leaves, leaf area index (LAI) was found significantly higher under application of 125% RDF over 75% RDF application and which was found at par with 100% RDF. Significantly the higher growth and yield parameter of cowpea *viz.*, plant height, number of functional leaves, leaf area index (LAI) of cowpea recorded by sole cropping over the rest of row arrangement.
In case of yield of maize, the higher values for green cob yield, straw yield and biological yield of maize were recorded under sole maize and among the nutrient levels application of 125% RDF application recorded the higher values for green cob yield, straw yield and biological yield. Similarly, the significantly higher seed yield, stover yield and biological yield was found under sole planting of cowpea and among the nutrient levels application of 125% RDF application recorded the higher values for seed yield, stover yield and biological yield. On the basis of maize equivalent yield, significantly higher maize equivalent yield observed under maize-cowpea 2:1 row arrangement with application of 100% RDF and which was found at par with the combination of 2:1 row arrangement with application of 125% RDF.

**Keywords:** Intercropping, maize, cowpea, row arrangements, nutrient levels, growth and yield

## Introduction
In India, 54.3% land is under irrigation and the rest is rainfed. The rainfed agro-ecosystem, the so-called grey patches untouched by green revolution, occupies a very important position in the Indian agriculture. It constitutes 67% of the net cultivated area in the country supports 40% of the India's population, contributes 44% to the national food basket, and accounts for nearly 75% of the oilseeds, 90% of the pulses, 70% of the cotton and finally agriculture contribute 16% GDP in national development. Among the state, Gujarat is considered to be an industrially developed state has almost 10% of its GDP coming from the agriculture sector (Nair, 2019).
The availability of land for agriculture is shrinking every day as it is increasingly utilized for non-agricultural purposes. World population is exponentially growing indicating the need for an attractive strategy for increasing productivity to fulfill their food requirements such as intercropping. Under this situation, one of the important strategies to increase agricultural output is the development of new high intensity cropping systems like intercropping systems. Intercropping plays an important role in the sustainable development of agriculture and food

production worldwide. Intercropping increases in productivity per unit of land via better utilization of resources, minimizes the risks, reduces weed competition and stabilizes the yield. Among different maize-based cropping system, maize-cowpea is emerging as potential maize-based cropping system in India.

Maize (*Zea mays* L.) is an annual $C^4$ plant belonging to the grassy family Poaceae with its origin as Central America and considered as one of the oldest food sources. Maize is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Globally, maize is known as "Queen of cereals" because it has the highest genetic yield potential among the cereals. Among maize types, sweet corn is one of commercial used maize type and planted for fresh market or processing (e.g., canning) uses. Sweet corn grains contain higher concentration of sugars than other corns. Sweet corn consumption has increased considerably worldwide.

Pulses play a vital role in biological nitrogen fixation, addition of considerable amount of organic matter through root biomass and leaf fall, deep root systems, mobilization of nutrients, protection of soil against erosion and improving microbial biomass, they keep soil productive and alive by bringing qualitative changes in physical, chemical and biological properties. Pulses are an important source of protein for human but have low productivity mainly because their cultivation is limited to marginal and sub-marginal conditions with almost no or low-input management. Cowpea (*Vigna unguiculata* L. Walp.) is a member of the Phaseoleae tribe of the leguminosae family. Members of the Phaseoleae include many of the economically important warm season grain and oilseed legumes, such as soybean, common bean, and mungbean. Cowpea is the most important summer crop next only to mung and has significant contribution in the pulse economy of the country. It is short duration crop, the seeds contain over 23 per cent protein, leaves and haulm constitutes fodder.

Spatial arrangement of component crops in intercropping influences the use of resources available to crops. There is potential for higher productivity of intercrops when mixtures are appropriately arranged to reduce the inter-specific competition for limiting resources, such as solar radiation, nutrients and water. Maximization of resources use by crops in mixture will therefore, depend on geometry and plant architecture of the component crops. An ideal spatial arrangement is the one which maximise the complementarily between the component crops, and enhance the physiological efficiency of the intercropping system in the given environment. The proper nutrient management is one of the major factors for increasing the percentage of nutrients availability in the soil which influences better growth and development of the crop. Variation in nutrient availability to the crop results in higher or lower yield, improved or reduced crop development and also fluctuates physiology of the crop.

Further aspect of row arrangement and nutrient levels probably receive more attention to know quantitative relationship and yield responses in intercropping research. Keeping in view the above facts the present study entitled Studies on growth and productivity of maize-cowpea intercropping system under different spatial arrangements and nutrient levels is planned to study the growth and yield attributes behaviour under maize-cowpea intercropping.

## Material and Methods

The experiment was conducted was carried out at during summer of 2019 and 2020 at College Farm, Navsari Agricultural University, Navsari (Gujarat). The soil of the experimental field was clayey in texture, low in organic carbon content (0.48 %) and available nitrogen (194.60 kg/ha), medium in available phosphorus (37.76 kg/ha) and fairly high in available potassium (293.51 kg/ha). The soil was slightly alkaline in reaction (pH 8.2). The experiment was laid-out in a factorial randomized block design with three replications. Treatment comprising five row arrangements *viz*., sole maize ($A_1$), sole cowpea ($A_2$), maize-cowpea (1:1) ($A_3$), maize-cowpea (1:2) ($A_4$) and maize-cowpea (2:1) and three nutrient levels *viz.*, 75% RDF ($F_1$), 100% RDF ($F_2$) and 125% RDF ($F_3$). Recommended dose of fertilizer used for maize and cowpea were 120:60:40 and 20:40:00 N:$P_2O_5$:$K_2O$ kg/ha respectively. Hybrid variety sugar 75 of maize and GC-6 of cowpea were taken as test crops during the investigation. The recommended dose of fertilizer (120:60:40 NPK kg/ha) for maize and (20:40:00 NPK kg/ha) for cowpea was applied. The required quantity of fertilizer was workout as per the unit area basis of maize and cowpea plant population. The net plot was harvested for biometric observation and harvested green fodder from net plots weighed for individual plots, the green cob yield and final green fodder yield was expressed in q/ha. All growth and yield attributes of the cowpea was recorded periodically before and after harvest of the crop. At the end the data was analyzed statistically as suggested by Panse and Sukhatme (1967) [23].

## Results and Discussion

### Growth attributes of maize and cowpea

### Plant height

#### Effect of row arrangements

The data on plant height of maize recorded at 30, 60 DAS and at harvest as influenced by various row arrangements and nutrient levels are given in Table 1 and the results showed that, plant height of maize and cowpea increased with advancing crop age up to harvest stage. Among the row arrangement, the sole maize and sole cowpea recorded the highest values on plant height at all three stages. The sole maize and sole cowpea were found at par with the 1:2 row arrangement. The highest plant height was recorded under sole maize mainly due to lower competition of cereal legume i.e., properly utilized light, solar radiation and nutrient. While, decrease in plant height in the intercropped situation, was ascribed to the fast growth of intercrops at an early growth stage and competition offered by intercrop for different environmental resources which suppressed the growth of the companion crop. Similar results were reported by Iderawumi (2014) [14], Rashwan and Zen El-Dein (2017) [26], Takele *et al.* (2017) [31], Abraha (2018) [1], Idoko (2018) [15], Patel *et al.* (2018) [12, 17, 24], Sujatha and Babalad (2018) [30] and Tamta *et al.* (2019) [32].

**Table 1:** Plant height of maize and cowpea as influenced by row arrangement and nutrient levels.

| Treatment | Plant height (cm) | | | | | |
|---|---|---|---|---|---|---|
| | Maize | | | Cowpea | | |
| | 30 DAS | 60 DAS | At harvest | 30 DAS | 60 DAS | At harvest |
| **A. Row arrangement** | | | | | | |
| $A_1$. Maize Sole | 48.41 | 158.29 | 220.96 | - | - | - |
| $A_2$. Cowpea Sole | - | - | - | 21.12 | 55.65 | 71.92 |
| $A_3$. Maize-Cowpea (1:1) | 43.97 | 141.42 | 178.51 | 17.95 | 49.76 | 64.52 |
| $A_4$. Maize-Cowpea (1:2) | 44.58 | 148.46 | 203.21 | 19.74 | 52.61 | 69.29 |
| $A_5$. Maize-Cowpea (2:1) | 40.96 | 139.35 | 172.30 | 17.28 | 44.56 | 60.14 |
| S Em± | 1.00 | 2.63 | 3.35 | 0.46 | 1.30 | 1.73 |
| CD at 5% | 2.85 | 7.51 | 9.55 | 1.32 | 3.70 | 4.94 |
| **B. Nutrient levels** | | | | | | |
| $F_1$. 75% RDF | 40.81 | 136.65 | 185.46 | 17.70 | 47.30 | 61.81 |
| $F_2$. 100% RDF | 45.34 | 150.93 | 194.99 | 19.28 | 51.22 | 67.97 |
| $F_3$. 125% RDF | 47.29 | 153.06 | 200.77 | 20.08 | 53.40 | 69.63 |
| S Em± | 0.87 | 2.28 | 2.90 | 0.40 | 1.13 | 1.50 |
| CD at 5% | 2.47 | 6.50 | 8.27 | 1.15 | 3.21 | 4.28 |
| **Interaction (A X B)** | | | | | | |
| S Em± | 1.73 | 4.56 | 5.80 | 0.80 | 2.25 | 3.00 |
| CD at 5% | NS | NS | NS | NS | NS | NS |
| Sig. interactions with Y | -- | -- | -- | -- | -- | -- |
| CV (%) | 9.55 | 7.61 | 7.34 | 10.35 | 10.88 | 11.06 |

**Effect of nutrient levels**

Maize and cowpea fertilized either with 125% RDF recorded the significantly highest plant height over 75% RDF and which was statistically at par with 100% RDF. The lowest plant height of maize and cowpea was recorded by 75% RDF during both years and over pooled analysis. However, pooled data at 30, 60 DAS and at harvest showed that the crop fertilized either with 125% or 100% RDF were equally effective on plant height of both crops and found significantly superior to 75% RDF. Significant effect of increase of plant height in cowpea with the application of 125 % RDF may be attributed to the fact that nitrogen being an essential constituent of plant tissue favours rapid cell division and its enlargement, which together with the adequate quantity of phosphorus and Potash helps in the rapid cell division and better development of the cell size. The same results were reported by Baghdadi *et al.* (2018) [5], Gudadhe *et al.* (2018) [12, 27], Prasanth *et al.* (2019) [25] and Tamta *et al.* (2019) [32].

**Number of functional leaves**

**Effect of row arrangements**

The periodical data on the number of functional leaves of maize and cowpea were significantly influenced by row arrangement and nutrient levels as presented in Table 2. The significantly highest number of functional leaves of maize were recorded by 1:2 arrangement over 1:1 and 2:1 arrangement at 30 DAS while at 60 DAS and at harvest which was found at par with sole maize. The lowest number of functional leaves was recorded by the 2:1 maize cowpea arrangement. The maximum number of functional leaves of cowpea was recorded by sole cowpea which was found on par with 1:2 row arrangements, while the lowest number of functional leaves was found under 2:1 row arrangement. Under least cereal- legume competition, adequate availability of light, optimum temperature, adequate space along with improvement in physiological and morphological characters might be responsible for a greater number of functional leaves per plant.

**Effect of nutrient levels**

Significantly the maximum number of leaves per plant of maize and cowpea was recorded with the application of 125 % RDF which was found at par with 100% RDF at 60 DAS and at harvest during both the years as well as in pooled analysis. The availability of the highest nutrient in the root zone leads to the release of nutrients from the soil complex with the help of increased activities of beneficial microorganisms resulted in better utilization of nutrients by cowpea for its development of the number of functional leaves per plant and all metabolic activities. The present result is in close agreement with Dangariya *et al.* (2017) [11], Gudadhe *et al.* (2018) [12, 27] and Tamta *et al.* (2019) [32].

**Leaf area index (LAI)**

**Effect of row arrangements**

The periodical data on LAI of maize and cowpea is significantly influenced by row arrangement and nutrient levels as presented in Table 3. The leaf area index (LAI) was increased with the advancement of crop stages and decreased thereafter due to senescence at maturity of the crop. Significantly the highest leaf area index (LAI) was registered in 1:2 row arrangement for both of the crops over rest arrangements which was found at par with 1:1 for maize at 30 and 60 DAS. In respect of cowpea the sole cowpea found the significantly superior over the all-row arrangements at 30, 60 DAS and at harvest.

**Table 2:** Number of functional leaves of maize and cowpea as influenced by row arrangement and nutrient levels.

| Treatment | Number of functional leaves | | | | | |
|---|---|---|---|---|---|---|
| | Maize | | | Cowpea | | |
| | 30 DAS | 60 DAS | At harvest | 30 DAS | 60 DAS | At harvest |
| **A. Row arrangement** | | | | | | |
| $A_1$. Maize Sole | 5.00 | 10.65 | 12.29 | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| $A_2$. Cowpea Sole | - | - | - | 10.68 | 25.75 | 21.65 |
| $A_3$. Maize-Cowpea (1:1) | 6.83 | 11.76 | 13.58 | 7.73 | 22.99 | 18.53 |
| $A_4$. Maize-Cowpea (1:2) | 7.78 | 12.35 | 13.73 | 10.14 | 25.02 | 20.99 |
| $A_5$. Maize-Cowpea (2:1) | 5.72 | 11.29 | 12.48 | 6.04 | 22.01 | 17.26 |
| S Em± | 0.18 | 0.24 | 0.29 | 0.22 | 0.55 | 0.45 |
| CD at 5% | 0.52 | 0.67 | 0.82 | 0.63 | 1.57 | 1.28 |
| **B. Nutrient levels** | | | | | | |
| $F_1$. 75% RDF | 5.96 | 10.80 | 11.87 | 7.76 | 22.44 | 18.43 |
| $F_2$. 100% RDF | 6.13 | 11.59 | 13.37 | 8.79 | 24.37 | 19.87 |
| $F_3$. 125% RDF | 6.92 | 12.15 | 13.82 | 9.40 | 25.02 | 20.53 |
| S Em± | 0.16 | 0.20 | 0.25 | 0.19 | 0.48 | 0.39 |
| CD at 5% | 0.45 | 0.58 | 0.71 | 0.55 | 1.36 | 1.11 |
| **Interaction (A X B)** | | | | | | |
| S Em± | 0.32 | 0.41 | 0.50 | 0.38 | 0.95 | 0.78 |
| CD at 5% | NS | NS | NS | NS | NS | NS |
| Sig. interactions with Y | -- | -- | -- | -- | -- | -- |
| CV (%) | 12.22 | 8.69 | 9.33 | 10.89 | 9.74 | 9.70 |

Thus, under least cereal- legume competition, adequate availability of light, optimum temperature, adequate space along with improvement in physiological and morphological characters might be responsible for significant improvement in leaf area index. The similar type of results was also observed by Sani *et al.* (2011) [28], Chaudhary *et al*. (2012) and Yavas and Unay (2016) [34].

**Effect of nutrient levels**

Data on leaf area per plant of maize and cowpea is presented in Table 3 periodically at 30, 60 DAS and at harvest which reveals that LAI of maize and cowpea was significantly affected by various nutrient levels. In respect of maize and cowpea application of 125% RDF produced significantly highest LAI over 75% RDF. Under the intercropping system the LAI of cowpea was showed the depression might be due to inter-crop competition and shading effects of maize on cowpea leads to decrease the incoming solar radiation for development of leaf area. Also, might be due to little competition exist for non-renewable resources like water, nutrients and incoming sunlight. The same type of results was reported by Pandey *et al.* (2016) [22], Kumar *et al.* (2017) and Baghdadi *et al.* (2018) [5].

**Yield**

**Green cob and straw yield of maize (q/ha)**

**Effect of row arrangement**

The green cob and straw yield (q/ha) were showed the significant positive response to row arrangement as presented in Table 3. The sole planting of maize recorded significantly the highest green cob yield and straw yield over 1:1 and 1:2 row arrangements and which was found at par with 2:1 row arrangement pattern. The lowest green cob yield and straw yield was recorded by 1:2 row arrangements. The higher green cob yield and straw yield under sole maize might be due to reduced cereal-legume competition and higher plant population, as the plants have to face neither nutrient nor moisture stress due to lower legume. Similar results were also reported earlier by Mbah and Ogbodo (2013) [19], Mandal *et al.* (2014) [18], Kokani *et al*. 2018 [17] and Sujatha and Babalad (2018) [30].

**Effect of nutrient levels**

In respect of nutrient levels also show the significant difference among them for green cob yield and straw yield as showed in Table 3. The application of 125% RDF found significantly superior for green cob yield and straw yield over the application of 75% RDF and which was found at par with 100% RDF. The lowest green cob yield and straw yield was recorded by 75% RDF may be due to insufficient supply of NPK for achieving the proper growth and development of maize crop. The liberal fertilization and enhanced nutrient uptake might have resulted in the improvement of growth parameter dry matter production and the yield attributes resulting in increased cob yield and straw yield. The present findings are in agreement with those of Almaz *et al.* (2017b) [3], Rathod *et al.* (2018) [27] and Prasanth *et al.* (2019) [25].

**Seed yield and stover yield of cowpea (q/ha)**

**Effect of row arrangement**

The mean data on seed yield and stover yield in cowpea was significantly influenced by row arrangement and nutrient levels during the present investigation as presented in the Table 3. Among the all-row arrangements sole cropping cowpea recorded the significantly higher seed yield and stover yield. None of the row arrangement was found comparable with sole cowpea for seed yield and stover yield.

**Table 3:** Leaf area index (LAI), yield and maize equivalent yield (MEY) of maize and cowpea as influenced by row arrangement and nutrient levels.

| Treatment | LAI | | Maize | | Cowpea | | MEY (q/ha) |
|---|---|---|---|---|---|---|---|
| | Maize | Cowpea | Green cob yield (q/ha) | Straw yield (q/ha) | Seed yield (q/ha) | Stover yield (q/ha) | |
| **A. Row arrangement** | | | | | | | |
| $A_1$. Maize Sole | 1.74 | - | 135.47 | 175.44 | - | - | 138.09 |
| $A_2$. Cowpea Sole | - | 2.80 | - | - | 12.93 | 30.72 | 38.78 |
| $A_3$. Maize-Cowpea (1:1) | 2.79 | 1.92 | 80.06 | 98.34 | 7.12 | 14.30 | 101.38 |
| $A_4$. Maize-Cowpea (1:2) | 3.28 | 2.35 | 55.21 | 70.69 | 8.95 | 20.63 | 82.77 |
| $A_5$. Maize-Cowpea (2:1) | 2.09 | 1.47 | 132.17 | 128.06 | 4.70 | 8.19 | 144.06 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| S Em± | 0.07 | 0.05 | 1.84 | 2.84 | 0.20 | 0.46 | 1.74 |
| CD at 5% | 0.19 | 0.13 | 5.25 | 8.09 | 0.56 | 1.32 | 4.92 |
| **B. Nutrient levels** | | | | | | | |
| $F_1$. 75% RDF | 2.13 | 1.97 | 83.33 | 96.51 | 6.35 | 13.96 | 81.90 |
| $F_2$. 100% RDF | 2.53 | 2.15 | 109.50 | 116.19 | 8.73 | 19.50 | 108.95 |
| $F_3$. 125% RDF | 2.77 | 2.29 | 109.34 | 141.70 | 10.19 | 21.92 | 112.19 |
| S Em± | 0.06 | 0.04 | 1.59 | 2.46 | 0.17 | 0.40 | 1.34 |
| CD at 5% | 0.16 | 0.11 | 4.55 | 7.01 | 0.49 | 1.14 | 3.81 |
| **Interaction (A X B)** | | | | | | | |
| S Em± | 0.11 | 0.08 | 3.19 | 4.92 | 0.34 | 0.80 | 3.01 |
| CD at 5% | NS | NS | 9.09 | 14.02 | 0.97 | 2.28 | 8.52 |
| Sig. interactions with Y | -- | -- | -- | -- | -- | -- | -- |
| CV (%) | 11.15 | 8.96 | 7.76 | 10.20 | 9.90 | 10.62 | 7.29 |

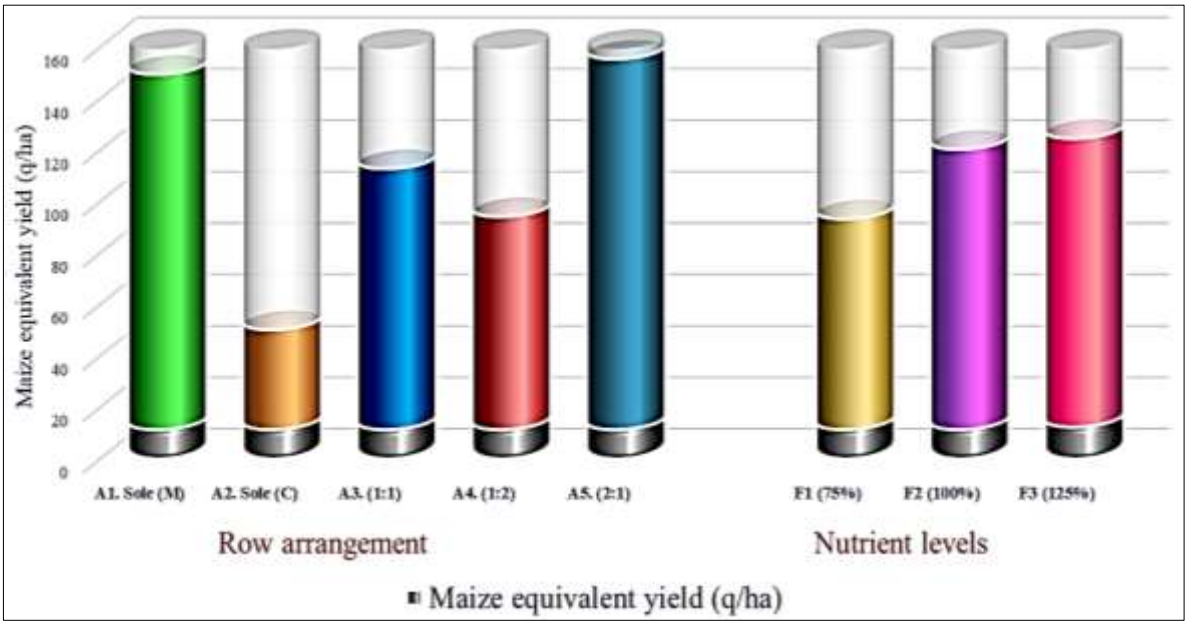


**Fig 1:** Maize equivalent yield influenced by row arrangement and nutrient levels at harvest.

There was positive correlation between crop growth rate, relative growth rate, net assimilation rate as well as light use efficiency of crop with seed yield and stover yield of crop. This shows that, growth parameters have positively influenced the seed and stover yield of cowpea also the no competition of maize. Higher plant population under sole cropping also reflects the higher seed yield and stover yield under sole cowpea. These results collaborated with those reported by Idoko (2018) [15], Sujatha and Babalad (2018) [30] and Amanullah and Nivethitha, (2020) [4].

**Effect of nutrient levels**

As regards to the performance of cowpea in terms of seed yield under different nutrient levels, a significant response to nutrient application was noticed from 75% RDF to 125% RDF during the experiment investigation. Significantly higher seed yield due to 125% RDF application was noticed and none of the nutrient levels found comparable with rest of nutrient levels. The higher seed yield under 125% RDF application may be due to sufficient supply of all resources and nutrient. Increase in yield under sole cowpea was due to the fact that the wider available space and reduced the competition for light and nutrients of maize, which probably provided favorable physical environments to produce higher seed yield and stover yield. The similar finding was observed by Ali *et al.* (2015) [2], Gul *et al.* (2015) [13], Saudy (2015) [29], Yadav *et al.* (2016) [33] and Chhetri and Sinha (2018) [9].

**Maize equivalent yield (MEY) (q/ha)**

**Effect of row arrangement**

Maize equivalent yield was significantly affected by the row arrangement during the present investigation and the data has been presented in Table 3 and graphically illustrated in Figure 1. Maize equivalent yield reflected the total productivity of the cropping system which showed significant improvement due to intercropping over sole cropping. Maize equivalent yield was recorded to be higher in all of the cases of intercropping with respect to pure stand yield of maize. Growing of maize with cowpea in 2:1 row arrangement recorded the significantly higher maize equivalent yield (MEY) over the sole cowpea, 1:1 and 1:2 row arrangements and found at par with the sole cropping of maize. However, among the intercropping system lowest MEY was observed under 1:2 row arrangement as compared to rest of all row arrangements. It might be due to better utilization of resources and balanced competition between components crops. Similar finding was also reported by Bedse *et al.* (2015) [7], Barik *et al.* (2016) [6], Chhetri (2016) [8], Jan *et al.* (2016) [16] and Mohanty *et al.* (2020) [20].

**Effect of nutrient levels**

Equivalent yield is an important index in assessing the performance of different crops under a given circumstance. Based on the price structure, economic yield of component crops is converted into base crop yield i.e., maize equivalent

yield. Maize equivalent yield showed the increasing trend as increase in the nutrient levels from 75% RDF up to 125% RDF as presented in Table 3. The nutrient levels showed the significant difference among them for MEY. In respect of nutrient levels, application of 125% RDF recorded the significantly higher MEY over the application of 75% RDF and which was found at par with 100% RDF. This might be owing to better utilization of applied nutrients and balanced competition between components crops. Hence, maize intercrop with cowpea, maize yield and extra yield of cowpea helped the increasing maize equivalent yield. These results are in conformity with the earlier findings of Bedse *et al*., 2015 [7], Yadav *et al.* (2016) [33], Naik *et al.* (2017) [21] and Chhetri and Sinha (2018) [9].

## Conclusion

On the basis of maize equivalent yield, significantly higher maize equivalent yield observed under maize-cowpea 2:1 row arrangement with application of 100% RDF and which was found at par with the combination of 2:1 row arrangement with application of 125% RDF. The planting of maize and cowpea in the row arrangements of 2:1 along with application of 100% RDF was found remunerative for obtaining the higher growth and yield of the maize- cowpea intercropping system and also for sustaining the soil health and productivity of system.

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