**Nutrient uptake of maize as influenced by intercropping with different genotype of groundnutunder temperate Kashmir valley**

Abstract :

A field experiment on" Nutrient uptake of maize as influenced by intercropping with different genotype of groundnut under temperate Kashmir valley" was conducted atSher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Wadura, Sopore during 2021 and 2022. The experimental soil exhibited silty clay loam characteristics with adequate drainage and normal levels of both reaction and salinity. The experimental treatments comprised of sole crops and various row proportions of maize intercropped with groundnut.The experimental design was randomized complete block design, consist nineteen treatments that were replicated three times. Treatment comprised of $T_1$(Sole maize, 60cm), $T_2$ (sole paired maize, 75-45-75 cm), $T_3$ (Sole paired maize,90-30-90 cm), $T_4$(Sole groundnut TG-84), $T_5$(Sole groundnut TG-37-A), $T_6$ (Sole groundnut TG-88), $T_7$ (Sole groundnut TG-89), $T_8$ Alternate row of maize + groundnut TG-84 (30 + 30cm ),$T_9$Paired row of maize + groundnut TG- 84 (75-45-75 cm maize in between 25-25cm groundnut),$T_{10}$ Paired row of maize + groundnut TG- 84 (90-30-90 cm maize in between 30-30cm groundnut),$T_{11}$ Alternate row of maize + groundnut TG- 37-A (30 + 30 cm)$T_{12}$Paired row of maize + groundnut TG- 37-A (75-45-75 cm maize in between 25-25cm groundnut),$T_{13}$ paired row of maize + Groundnut TG- 37-A (90-30-90 cm maize in between 30-30cm groundnut),$T_{14}$ Alternate rows of maize + Groundnut TG- 88 (30 + 30 cm),$T_{15}$Paired row of maize + groundnut TG- 88 (75-45-75 cm maize in between 25-25cm groundnut), $T_{16}$ Paired row of maize + groundnut TG- 88 (90-30-90 cm maize in between 30-30cm groundnut), $T_{17}$ Alternate rows of maize + groundnut TG- 89 (30 + 30 cm),$T_{18}$ Paired row of maize + groundnut TG- 89 (75-45-75 cm maize in between 25-25cm groundnut), $T_{19}$ Paired row of maize+ groundnut TG- 89 (90-30-90 cm maize in between 30-30cm groundnut). The two years of result revealed that intercropping increased the total N, P and K enhancing yield of both the crop. Total N,P and K uptake was recorded significantly higher with paired row of maize (75/45 cm spacing)in intercrop with groundnut variety TG-37 as compared to sole maize. In intercrop N,P and K uptake was recorded significantly higher in sole groundnut variety TG-37 followed by TG-84, TG-88 and TG-89. Key words?

## Introduction

Current global agriculture is under significant pressure due to the challenges of continuous population growth, the looming threat of climate change, reduction in available farmland and the depletion and pollution of water resources. Additionally, evolving consumer demands contribute to the complex landscape faced by agriculture today (Hossain et al., 2021; Zaman et al., 2017; Maitra et al., 2018). In nations such as India, where a substantial proportion of farmers fall within the small and marginal categories, challenges abound. These include the year-round engagement of family labour, the imperative to produce an ample supply of nutritionally rich foods, and the pursuit of livelihood enhancement. Given these circumstances, there is a recognized necessity to maximize productivity per unit area and optimize resource utilization. Intercropping emerges as a viable solution in this context, holding the potential to enhance both crop yield and farm income within a unit area, showcasing superior land use efficiency (Gitari et al., 2020). Additionally, intercropping is acknowledged for its reduced input requirements, specifically in terms of chemical fertilizers and pesticides, leading to the production of environmentally safe food in a sustainable manner (Maitra and Gitari, 2020; Duvvada and Maitra, 2020). intercropping is a traditional agricultural practice involving the simultaneous cultivation of two or more crops in the same field (Willey, 1979; Maitra, 2020). In essence, it can be affirmed that intercropping has the potential to contribute to poverty alleviation, hunger reduction, and the provision of nutritious foods for small-scale farmers. In this context, maize (Zea mays L.) stands out as a particularly

suitable choice, as highlighted in research findings (Panda et al., 2021). The primary goal of intercropping is to enhance productivity within a given land area and time frame by utilizing land resources and farming inputs, including labour, in an equitable and judicious manner. This is achieved without compromising the yield of the main crop, as emphasized by Marer et al.,2007. In maize-based cropping systems, incorporating legumes is considered a favourable alternative for enhancing nitrogen economy and increasing maize yield. Additionally, legumes contribute to bonus yield, heightened productivity per unit of time and space, and increased net returns compared to monoculture (Seran and Brintha, 2010). This is attributed to the differential rooting habits, varied growth patterns, resource demands, and complementary interactions facilitated by nitrogen fixation in legumes, which result in substantial organic biomass (leaves, nodules, roots, etc.). According to Kamanga et al. (2010), The observation in farmers' fields revealed that intercropping legume crops with maize resulted in the greatest quantity of vegetative biomass (Amos et al., 2012).Globally, maize is cultivated across an expanse of 193.7 million hectares, yielding a total production of 1147.7 million metric tonnes and achieving a productivity rate of 5.75 tonnes per hectare (FAO, 2020). Within the roster of maize-growing nations, India holds the 4th position in terms of cultivated area and the 7th position in terms of production (Anonymous, 2022). The United States stands as the leading maize producer, accounting for approximately 36% of the total production, which amounts to 30.2 million metric tonnes (DES, 2020).In the region of Jammu and Kashmir, maize is cultivated across an area spanning 0.31 million hectares, resulting in a production output of 0.51 million tonnes and a productivity rate of 1.65 tonnes per hectare.

## Material and Methods

The study took place at the Faculty of Agriculture during the kharif season of 2021 and 2022 at Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Wadura, Sopore. The experimental soil exhibited silty clay loam characteristics with adequate drainage and normal levels of both reaction and salinity. Throughout the crop period, during 2021 the mean temperature varied between35.5°C and 6.7°C.during 2022 the mean temperature varied between 32.6°C and 4.6°C. The cumulative precipitation amounted during 2021was approximately 476.3 mm, and during 2022 was 420.8 mm evenly distributed throughout the crop period. The levels of soil organic carbon and available NPK fell within the medium range.The experimental treatments comprised sole crops and various row proportions of maize intercropped with groundnut.The experimental design was randomized complete block design, consist nineteen treatments that were replicated three times. Treatment comprised of $T_1$ (Sole maize, 60 cm), $T_2$ (sole paired maize, 75-45-75 cm), $T_3$ (Sole paired maize,90-30-90 cm), $T_4$ (Sole groundnut TG-84), $T_5$ (Sole groundnut TG-37-A), $T_6$ (Sole groundnut TG-88), $T_7$ (Sole groundnut TG-89), $T_8$ Alternate row of maize + groundnut TG- 84 (30 + 30cm ),$T_9$Paired row of maize + groundnut TG- 84 (75-45-75 cm maize in between 25-25cm groundnut),$T_{10}$ Paired row of maize + groundnut TG- 84 (90-30-90 cm maize in between 30-30cm groundnut), $T_{11}$ Alternate row of maize + groundnut TG- 37-A (30 + 30 cm)$T_{12}$Paired row of maize + groundnut TG- 37-A (75-45-75 cm maize in between 25-25cm groundnut), $T_{13}$ paired row of maize + Groundnut TG- 37-A (90-30-90 cm maize in between 30-30cm groundnut), $T_{14}$ Alternate rows of maize + Groundnut TG- 88 (30 + 30 cm),$T_{15}$Paired row of maize + groundnut TG- 88 (75-45-75 cm maize in between 25-25cm groundnut), $T_{16}$ Paired row of maize + groundnut TG- 88 (90-30-90 cm maize in between 30-30cm groundnut), $T_{17}$ Alternate rows of maize + groundnut TG- 89 (30 + 30 cm),$T_{18}$ Paired row of maize + groundnut TG- 89 (75-45-75 cm maize in between 25-25cm groundnut), $T_{19}$ Paired row of maize+ groundnut TG- 89 (90-30-90 cm maize in between 30-30cm groundnut). Other management operations were carried out following the recommended package of practices for both the main and intercrops.During 2021and 2022 the crop was sown during 22$^{nd}$ and 21$^{st}$standard meteorological week (SMW) and harvest during 39$^{th}$ and 40$^{th}$ standard meteorologicalweek.Statistical comparisons were conducted for all the parameters among the treatments.

**Result and Discussion**

The uptake of nutrients by maize and intercrops was influenced by the specific combination and proportion in the intercropping system.Nutrient like Nitrogen, Phosphorus and Pottasium uptake of maize during both the year of 2021 and 2022 were recorded significantly higher with paired row of maize (75-45-75 cmspacing) intercrop with groundnut variety TG-37 (25-25 cm) as compared to sole maize, but paired row of maize (75-45-75 cmspacing)was at par with paired row of maize (90-30-90 cmspacing) intercrop with groundnut variety TG-89. In intercrop during 2021 and 2022 nutrient uptake was recorded significantly higher with sole groundnut variety TG-37 and lowest was with TG-89, within the intercrop highest nutrient uptake were recorded with paired row of groundnut intercrop with maize (90-30-90 cm spacing). This might be due to increased nutrient uptake could be attributed to the improved availability and supply of nitrogen provided by the leguminous crops intercropped with maize.intercropping with legumes could have stimulated a diverse array of rhizosphere microbes, facilitating the mobilization of inherent phosphorus (P) and potassium (K) nutrients. This process, coupled with the fixation of nitrogenand enhancing availability by legume components, likely increased the uptake of nutrients by plants.Nutrient absorption is increased in the in the maize-legume intercropping system compared to sole maize cultivation (Chalka and Nepalia, 2006).Legumes and maize intercropped successfully inhibited weed development and increased potassium, phosphorus, and nitrogen uptake (Katsaruware and Manyanhaire, 2009; Eskandari and Ghanbari, 2010).

**Table 1: Nutrient uptake of maize as influenced by intercropping with different genotype of groundnut**

| | Maize Nutrient Uptake kg ha$^{-1}$ | | | | | | | Intercrop Nutrient Uptake kg ha$^{-1}$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | | P | | K | | Treatment | N | | P | | K | |
| Treatment | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 | | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 |
| MS(60cm) | 88.9 | 92.5 | 34.7 | 35.8 | 160.20 | 164.27 | TG84(30cm) | 151.83 | 156.61 | 17.53 | 18.92 | 67.06 | 69.33 |
| MS (75-45-75) | 97.9 | 97.4 | 42.1 | 42.4 | 164.13 | 179.30 | TG37(30cm) | 166.59 | 170.55 | 18.97 | 19.53 | 71.98 | 73.85 |
| MS(90-30-90) | 94.5 | 95.4 | 40.9 | 39.5 | 175.10 | 165.29 | TG88 (30cm) | 151.94 | 151.59 | 17.65 | 18.07 | 66.74 | 67.45 |
| M+TG84(1:1) 30cm | 105.6 | 107.8 | 43.5 | 49.6 | 183.74 | 186.22 | TG89(30cm) | 145.07 | 153.74 | 17.04 | 17.63 | 66.21 | 69.52 |
| M+TG84(2:2)25cm | 114.2 | 113.8 | 48.8 | 50.6 | 188.04 | 187.79 | M+TG84(1:1) 30cm | 48.03 | 47.22 | 5.07 | 5.19 | 23.02 | 22.38 |
| M+TG84(2:2)30cm | 105.9 | 110.3 | 45.0 | 47.9 | 183.46 | 186.08 | M+TG84(2:2)25cm | 48.46 | 49.35 | 5.44 | 5.77 | 23.45 | 24.25 |
| M+TG37(1:1)30cm | 112.1 | 114.4 | 46.3 | 50.5 | 180.39 | 185.93 | M+TG84(2:2)30cm | 50.34 | 51.85 | 5.78 | 6.24 | 24.05 | 25.00 |
| M+TG37(2:2)25cm | 116.9 | 119.7 | 53.3 | 54.7 | 199.77 | 201.01 | M+TG37(1:1)30cm | 50.94 | 54.18 | 5.52 | 6.03 | 24.00 | 26.14 |
| M+TG37(2:2)30cm | 112.0 | 117.0 | 50.4 | 50.8 | 197.22 | 199.16 | M+TG37(2:2)25cm | 54.30 | 56.42 | 6.30 | 6.55 | 25.67 | 26.88 |
| M+TG88(1:1)30cm | 101.9 | 107.2 | 43.9 | 46.5 | 175.23 | 177.07 | M+TG37(2:2)30cm | 55.16 | 57.65 | 6.38 | 6.58 | 26.38 | 27.23 |
| M+TG88(2:2)25cm | 111.8 | 107.1 | 50.0 | 50.7 | 184.80 | 185.87 | M+TG88(1:1)30cm | 36.83 | 40.90 | 3.99 | 4.41 | 17.37 | 19.19 |
| M+TG88(2:2)30cm | 107.2 | 107.7 | 44.7 | 48.7 | 181.17 | 185.28 | M+TG88(2:2)25cm | 39.19 | 42.29 | 4.16 | 4.79 | 18.42 | 20.35 |
| M+TG89(1:1)30cm | 102.8 | 103.1 | 47.0 | 47.2 | 189.01 | 192.75 | M+TG88(2:2)30cm | 41.07 | 43.25 | 4.60 | 5.24 | 19.13 | 20.52 |
| M+TG89(2:2)25cm | 110.5 | 116.5 | 49.2 | 52.7 | 187.75 | 192.57 | M+TG89(1:1)30cm | 42.65 | 44.66 | 4.52 | 5.15 | 19.58 | 21.59 |
| M+TG89(2:2)30cm | 108.8 | 114.2 | 43.7 | 50.8 | 184.40 | 190.32 | M+TG89(2:2)25cm | 42.19 | 47.20 | 4.70 | 5.94 | 19.44 | 23.39 |
| | | | | | | | M+TG 89(2:2)30cm | 43.93 | 50.40 | 4.94 | 6.22 | 20.27 | 25.33 |
| SEM (+) | 4.0 | 2.9 | 3.1 | 1.8 | 4.83 | 4.85 | SEM (+) | 4.09 | 3.62 | 0.34 | 0.37 | 1.36 | 0.95 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CD(p<0.05)** | **11.7** | **8.3** | **9.0** | **5.4** | **13.99** | **14.05** | **CD(p<0.05)** | **11.82** | **10.46** | **0.97** | **1.08** | **3.92** | **2.75** |

## Conclusion

From the above findings it can be conclude that nutrient uptake was significantly higher with paired row of maize (75-45-75 cm spacing) in intercrop with groundnut variety TG-37 as compare to sole maize crop during both the year 2021 and 2022.



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