Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(2): 807-810
Received: xx-01-2018
Accepted: xx-02-2018

Prabhat Kumar
M.sc. Scholar,
Department of Agronomy,
Dr. Rajendra Prasad Central
Agriculture University
Pusa, Samastipur, Bihar, India

M Kumar
Uni. Professor- cum- Chief Scientist, Department of Agronomy, Tirhut College of Agriculture, Dr. Rajendra Prasad Central Agriculture University, Pusa, Samastipur, Bihar, India

Kaushal Kishor
PhD. Scholar, Department of Agronomy, Dr. Rajendra Prasad Central Agriculture University Pusa, Samastipur, Bihar. India

Randhir Kumar
M.sc. Scholar, Department of Agronomy, Dr. Rajendra Prasad Central Agriculture University Pusa, Samastipur, Bihar, India

Correspondence
Prabhat Kumar
M.sc. Scholar,
Department of Agronomy,
Dr. Rajendra Prasad Central
Agriculture University
Pusa, Samastipur, Bihar, India

Effect of nutrient management on yield and yield attributes of Maize (*Zea mays* L.) under different tillage practices

Prabhat Kumar, M Kumar, Kaushal Kishor and Randhir Kumar

Abstract
A field experiment was carried out during *kharif* season of 2016 at Crop research farm TCA Dholi, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, (Bihar) to study "Effect of nutrient management on yield and yield attributes of Maize (*Zea mays* L.) under different tillage practices". The experiment was laid out in a Split plot Design with three replication. Main plot consist of three different tillage practices viz., a) Zero tillage (ZT), b) Conventional tillage (CT) and c) Bed planting (BT) and sub plot comprised of four different level of nutrient management viz., a) Recommended dose of fertilizer (RDF) (120, 60 and 50 kg/ha N, P_2O_5 and K_2O), b) Site Specific Nutrient Management (SSNM) based on nutrient expert and c) Farmers practice (FP) (150% of RDF + 10 ton FYM). Highest yield attributes and yield viz., cobs/plant, length of cobs, grains/cob, girth of cobs, test weight and grain yield were observed under bed planting tillage practices which was significantly superior over remaining tillage practices while highest yield attributes and yield were obtained under farmer practices which was significantly superior over recommended dose of fertilizer but statistically at par with site specific nutrient management practices.

Keywords: Maize, yield, yield attributes, tillage practices, nutrient level

Introduction
Maize (*Zea mays* L.) is the third most important cereal crop of India after rice and wheat and there is great scope to increase the present maize yield. It is cultivated in area of 92.58 lakh ha with a production of 236.73 lakh tonnes and productivity of 25.57 q/ha (Directorate of Economics and Statistics, 2016) [1]. There is no other cereal crop which has such immense productivity potential as maize and therefore, maize occupies the unique place as "Queen of Cereals". Now-a-days, maize is gaining importance in conservation agriculture as it is a widely spaced crop having slow growth rate in its early stage which leads to more loss of water and nutrient. To overcome this problem, adoption of conservation agriculture-based crop-management practices are increasing in maize production area of India. But production is limited by low fertilizer use efficiency, inadequate existing fertilizer recommendations and the ignorance of nutrients balance that are posing serious threat in maize production. Many beneficial effects of no-till/zero-till and minimum tillage have also been reported like increased porosity, organic carbon, water holding capacity and decreases bulk density. Similarly, bed planting system have also been reported very beneficial for improving soil environment for better plant growth development with minimum requirement of irrigation water. Sub-soiling is again a newly introduced intervention to break down the hard pan for improving field drainage and provides better soil tilth.

Materials and Methods
The field experiment was conducted to study "Effect of nutrient management on yield and yield attributes of Maize (*Zea mays* L.) under different tillage practices" during *kharif* season of 2016 at crop research farm of TCA Dholi, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur (Bihar). The experimental area Dholi falls in humid sub-tropical climatic zone, which is influenced greatly by monsoon. It is situated at 25.98^0 N latitude, 85^0E longitude and 52.3 meters above mean sea level. The experiment was laid out in a Split plot Design with three replication. Main plot consist of three different tillage practices viz., a) Zero tillage (ZT), b) Conventional tillage (CT) and c) Bed planting (BP) and sub plot comprised of four different level of nutrient management viz., a) Recommended dose of fertilizer (RDF) (120, 60 and 50 kg/ha N, P_2O_5 and K_2O), b) Site Specific Nutrient Management (SSNM) based on nutrient expert and c) Farmers practice (FP) (150% of RDF + 10 ton FYM). A plot having uniform fertility and even topography was selected for experimental trial.

The experimental area was ploughed except zero tillage with a tractor driven plough and cross harrowing was done thrice with help of disc harrow. Pre-sowing irrigation was given 7 days before land preparation to ensure adequate moisture content in the soil for better germination.

Seed rate of 20 kg/ha was used for sowing of maize. Furrows were opened at 67 cm apart by narrow spade (kudali) and seeds were sown in furrows at a depth of 3-4 cm maintaining plant to plant distance of 20 cm. Thinning and gap filling were done at 20 days after sowing, where ever required. One pre-emergence spray of atrazine @ 2.0 kg/ha was done after sowing followed by two manual weeding at 25 and 56 days after sowing for effective weed control in maize. One pre-sowing irrigation was given before land preparation especially to provide sufficient moisture for better germination of seed and other irrigations were scheduled at critical growth stages viz., six leaf stage, knee height stage, tassel emergence, 50 per cent silking and at dough stage. Usual plant protection measures were adopted to protect the crop from insect pests and diseases and when required. The crop was harvested when the cobs become nearly dry and plants showed physiological maturity (yellowing). First, the cobs were removed from the standing crop and the stover was harvested latter. The harvested cobs were kept in separate gunny bags for each plot and dried under the sun before shelling. After shelling, moisture per cent in grain and yield kg/plot were recorded each plot and then converted into q/ha at 15 per cent moisture level. Five plants from net plot were randomly taken and tagged from second row of each plot for recording the observations at different stages of growth at 30 days interval i.e. 30, 60, 90 and 150 days after sowing. Yield was recorded after harvesting. Number of cobs/plant was calculated from total number of cobs/plot divided by total number of effective plants/plot. For length of cob (cm) three cobs were randomly taken from each plot at the time of harvesting. The husk was removed and length was measured with the help of scale and average was expressed in cm. The cob girth of three corn were measured with the help of vernier calliper and the average value was expressed in cm. After shelling five cobs randomly taken cobs, the numbers of grains were counted and the mean value was worked out to obtain the number of grains/cob. From each plot 1000-grains were counted and their weight was recorded to obtain the test weight in gram. Grain weight were taken from each plot in kg/plot converted into q/ha. The plants of each plot were cut from ground level after removal of the cobs. The stover was allowed to sundry to obtain a constant weight which gave the stover yield in kg/plot and converted into q/ha. The cobs after shelled remain stone were sun dried to obtain a constant weight which gave the stone yield in kg/plot and converted into q/ha. The harvest index was calculated by dividing the economic (grain) yield to the total biological yield (grain, stover and stone) and multiplying the factor by 100.

$$\text{HI (\%)} = \frac{\text{Grain yield (q/ha)}}{\text{Grain yield (q/ha)+Stover yield (q/ha)+stone yield (q/ha)}} \times 100$$

Result and Discussion

The results obtained from the present investigation are presented in Table 1 and 2.

Table 1: Effect of nutrient management and different tillage practices on yield attributes of Maize

Treatments	No. of cobs/plant	Length of cob(cm)	Girth of cob(cm)	No. of grains/cob	Test Weight(g)
Tillage Practices					
ZT	1.18	15.22	13.49	359.52	261.58
CT	1.14	14.19	13.36	344.76	252.42
BP	1.29	15.72	13.99	374.00	280.33
S.E m ±	0.02	0.01	0.006	1.42	2.53
C.D. (P=0.05)	0.06	0.04	0.026	5.74	10.23
Nutrient Management					
RDF	1.13	14.59	13.46	334.55	257.39
SSNM	1.16	15.05	13.67	345.78	263.16
FP	1.24	15.49	13.76	349.33	268.74
S.E m ±	0.02	0.004	0.004	1.65	1.70
C.D. (P=0.05)	0.05	0.011	0.012	5.15	5.30

Table 2: Effect of nutrient management and different tillage practices on Grain yield, Stover yield, Stone yield and Harvest Index of maize

Treatments	Grain yield(q/ha)	Stover yield(q/ha)	Stone yield(q/ha)	Harvest Index%
Tillage Practices				
ZT	57.95	92.15	13.87	35.31
CT	54.16	81.88	12.44	36.56
BP	63.43	105.95	16.62	33.97
S.E m ±	0.38	1.76	0.43	0.031
C.D. (P=0.05)	1.51	7.12	1.74	0.124
Nutrient Management				
RDF	56.87	89.35	13.50	36.20
SSNM	58.47	93.15	14.03	35.73
FP	60.21	97.47	15.40	34.92
S.E m ±	0.68	1.28	0.30	0.007
CD (P=0.05)	2.12	3.99	0.95	0.020

No. of cobs/plant

The number of cobs per plant was significantly influenced by the tillage practices. Maximum number of cobs per plant was recorded under bed planting (1.29 cobs/plant) and minimum number cobs per plant was observed under conventional tillage (1.14 cobs/plant). Higher number of cobs/plant was might due to better plant growth under bed planting mainly because of higher leaf area that facilitated more formation of photosynthates and its translocation from sink to source. There was also significant influence of nutrient management on number of cobs per plant. Maximum number of cobs was observed with farmer practices (1.23 cobs/plant) followed by SSNM (1.16 cobs/plant) and RDF (1.13 cobs/plant).

Length of cob (cm)

The tillage practices had significant effect on cob length. The maximum cob length was recorded under bed planting (15.72 cm) tillage practices followed by zero tillage (15.22 cm) and conventional tillage (14.19 cm). There was also significant influence of nutrient management on length of cob. The maximum cob length was recorded in farmer practices (15.47 cm) nutrient level followed by SSNM (15.05 cm) and lowest length of cob was recorded in RDF (14.57 cm) nutrient level. The longer cobs length might be due to increased cell division and expansion. The similar results was also reported by Pandey (2015) [2].

Girth of cob (cm)

The effect of tillage practices on girth of cob was found significant. The maximum girth of cob was recorded under bed planting (13.99 cm) tillage practices followed by zero tillage (13.49 cm) and lowest value found was under conventional tillage (13.36 cm) practices. The highest cob girth was found under bed planting due to higher leaf area coupled with more formation of photosynthates and its translocation to reproductive parts helped for better development of cobs. Effect of nutrient management on girth of cob was also recorded significant. The maximum girth of cob recorded under farmer practices (13.76 cm) nutrient management followed by SSNM (13.67 cm) and lowest girth of cob was recorded in RDF (13.46 cm) nutrient management. Higher cob girth at higher dose of fertilizer was result of more cell-division and cell-elongation. Nagvani and Subbian (2014) [3] also confirmed the above result.

No. of grains/cob

Bed planting (374) tillage practices recorded significantly highest no. of grains per cob followed by zero tillage (359.52) and lowest value was recorded in conventional tillage (344.76) practices. Significant influence of nutrient management was observed in case of no. of grains/cob. The maximum no. of grains/cob found in farmer practices (349.33) followed by SSNM (345.78) and lowest value was recorded at RDF (334.55) nutrient management. The increasing of fertilizer dose enhanced the no. of grains per cob.

Test weight (gm)

The maximum test weight was found under bed planting (280.33 gm) tillage practices. The lowest test weight found under conventional tillage (247.42 gm) practices. This might be due to more availability of essential nutrients, moisture and plant growth in bed planting. These factors positively reflected on higher photosynthesis rate, accumulation of more assimilates during the reproductive phase which in turn increase the sink size i.e produced bold grains in the cob. Similar findings were also reported by Meena *et al.*, (2012) [4] and Pinjari *et al.*, (2008) [5]. The nutrient management had also significant effect on test weight and significantly higher test weight was recorded in farmer practices (268.74 gm) followed by SSNM (263.16) and the lowest value recorded at RDF (257.39) nutrient management.

Grain yield (q/ha)

Statistical analysis of data collected during investigation showed that there was significant effect of tillage practices on grain yield on *kharif* maize crop. Grain yield was found significantly superior under bed planting (63.43 q/ha) over tillage practices followed by zero tillage practices (57.95 q/ha) and lowest value of grain yield under conventional tillage (54.16 q/ha) practice. The higher grain yield is the cumulative results of greater values of cob length, cob girth, grain weight per cob and also test weight. Also reported similar results. Effect of nutrient management significantly influenced grain yield on *kharif* maize crop. Significantly highest grain yield was recorded in farmer practices (60.21 q/ha) nutrient management which was statistically at par with SSNM (58.46 q/ha). The lowest grain yield was recorded in RDF (56.87 q/ha) nutrient level. The higher grain yield is the cumulative effect of higher values of yield attributes. These results are in conformity with Pandey *et al.*, (2015) [2], Layek *et al*., (2012) [6] and Mashingaidge *et al*., (2010) [7] who reported significantly higher grain yield of corn at 150 % of recommended dose of nitrogen.

Stover yield (q/ha)

Statistical analysis of data collected during investigation showed that there was significant effect of tillage practices on stover yield in *kharif* maize crop. Stover yield obtained with tillage practices recorded maximum under bed planting tillage (105.95 q/ha) practices. The lowest value found in conventional tillage (81.88 q/ha) practices. The nutrient management had significant effect on stover yield. The maximum stover yield was recorded under farmer practices (97.47 q/ha) nutrient level. The lowest value found in RDF (89.35 q/ha) nutrient level. The higher stover yield at higher dose of fertilizer was due to better plant growth and development including plant dry matter. The present findings lend to support from the results of Khadatre *et al.*, (2006) [8].

Stone yield

The tillage practices had significant effect on stone yield. The maximum stone yield was recorded under bed planting (16.62 q/ha) tillage practices. The lowest value found under in conventional tillage (12.44 q/ha) practices. Tillage practices had significant effect on stover and stone yield. This might be due to increased plant height, increase leaf area, dry matter accumulation. Effect of nutrient management significantly influenced stone yield in *kharif* maize crop. Significantly highest stone yield was recorded under farmer practices (15.40 q/ha) nutrient management followed by SSNM (14.03 q/ha). The lowest stone yield was recorded in RDF (13.50 q/ha) nutrient level.

Harvest index (%)

Statistical analysis of data showed significant effect on tillage practices. Its maximum value was recorded with conventional tillage (36.56%), followed by zero tillage (35.31%) and bed planting (33.97%) tillage system. The higher harvest index was recorded under bed planting tillage practices mainly because of higher economic yield of maize and lower biological yield compared to other tillage practices. Statistical analysis of data showed significant effect on nutrient management. Its maximum value was recorded with RDF (36.20%), followed by SSNM (35.73%) and farmer practices (34.92%) nutrient level. Harvest index under farmer practices nutrient management was the results of more economic yield as compared to SSNM and RDF. Pandey (2015) [2] also found significant difference in harvest index at 75% and 100% nitrogen application.

Conclusion
The experimental evidences warrant the following specific conclusion which may be adopted for better crop yield in maize during Kharif season**.** Yield and yield attributes of maize in bed planting was found significantly superior over rest of tillage practices. Yield and yield attributes of maize under nutrient management practices farmer practices was found significantly superior over RDF but statistically at par with SSNM.

References
1. Directorate of Economics and Statistics, 2016.
2. Pandey D. Nitrogen management maize based legume intercropping. Thesis. G.B. Pant university of Agriculture and Technology, Pantnagar (Uttarakhand), 2015, 152.
3. Nagavani AV, Subbian P. Productivity and economics of hybrid maize as influenced by integrated nutrient management. Current Biotica, 2014; 7(4):283-293.
4. Meena SR, Kumar A, Jat NK, Meena BP, Rana DS, Idnani LK. Influence of nutrient sources on growth, productivity and economics of baby corn (*Zea mays*) mung bean (*Vigna radiata*) cropping system. Indian Journal of Agronomy. 2012; 57(3):217-221.
5. Pinjari SS, Zarapkar DS, Bhondve TS, Suryawanshi JS. Effect of level nitrogen and spacing on quality parameters, nutrient uptake of baby corn (*Zea ma*ys L.) and soil health. Journal of Advances in Science and technology. 2008; 11(1-2):58-63.
6. Layek J, Shivakumar BG, Rana DS, Munda S, Lakshman K. Growth pattern, physiological indices and productivity of different soyabean (*Glycine max*) based intercrops as influenced by nitrogen nutrition. Indian Journal Agronomy. 2012; 57(4):349-356.
7. Mashingaidze AB, Lotz LA, Werf WV, Kropff MJ, Nabwami J. The influence of fertilizer placement on maize yield and growth of weeds. Scientific conference Proceedings, 2010, 161-166.
8. Khadatre SV, Patel MV, Jadhav JD, Monakashi DD. Effect of vermicompost on yield and economics of sweet corn. Journals of soils & Crops. 2006; 16(2):401-406.