Research Journal of Agriculture and Forestry Sciences _____ ISSN 2320-6063
Vol. **5(2),** 1-4, February **(2017)** *Res. J. Agriculture and Forestry Sci.*

Effects of Urea, DAP, Potash and their mixture on seed germination and seedling growth of Maize (*Zea mays*)

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Available online at: www.isca.in, www.isca.me
Received 2nd January 2017, revised 1st February 2017, accepted 6th February 2017

Abstract

Maize is an important cereal crop of the world. In term of area under cultivation and production, it ranks only next to wheat and rice. The maize seeds were selected for present investigation to assess the effects of different chemical fertilizer on seed germination and seedling growth. Seeds were treated with applied chemical fertilizer i.e. urea, potash, DAP and their mixture at 3% and 5% level and different parameters have been observed. Urea and potash found more effective for different parameters at 3% level while at 5% level most of treatment caused various growth inhibitions. Reductions in germination percentage and seedling growth were some of the most conspicuous effects.

Keywords: Fertilizer, DAP, Urea, Yield, Productivity.

Introduction

Chemical fertilizer is an essential macro nutrients and determinant in growth and development of different crops. The use of chemical fertilizers i.e. Urea, DAP (Diamoniam phosphate), and Potash are considered to be the rich plant nutrient in the form of manure for better growth and high yield. The need for fertilizer application is widely recognized as it is readily observed that plants grown in soil with freshly applied fertilizer shows better response to growth and yield[1]. Fertilizer experiments have for the most part been concerned with the study of yields, and the problem of modifying the composition of the plant has been much less often the principal objective[2]. The use of fertilizer in the production of maize will not only improve yield but will also increase the income of local farmers[3]. The maize plant is a heavy feeder and it requires more nitrogen, potash, phosphorus, calcium and magnesium for germination and growth.

Maize is an important crop that has worldwide significance as it is a good source of food not only for human but also for livestock[4]. It is also a source of raw materials for industries to produce products such as corn flakes, corn oil, corn syrup and products of fermentation and distillation are produced from maize[5]. The objectives of present study was to investigate rate of chemical different fertilizers uptake, fertilizer use efficiency, grain yield and its components under chemical fertilizers and these results could be useful for selecting of fertilizers which increases yield and improves quality and quantity.

Materials and methods

The Experiment was carried out during May 2014. Urea, DAP, Potash and their mixture have been selected at 3% and 5% level for present study. Maize seeds were collected from Poonch District (J&K). The experiment was carried out with 9 petridishes that was arranged and lined with single layer of filter paper. Applied seeds were thoroughly cleaned manually and 8 seeds were carefully placed into each petridishes using forceps. Separate control set with seeds soaked in distilled water for the same duration was also arranged for comparison. All petridishes were kept at room temperature $25^0c \pm 18^0c$ and continuously treated with water and respective chemical fertilizers. The experiment was divided into two Phases -

Treatment before seed germination: In this phase seeds were kept in petridishes on single fold of filter paper and treated with the applied chemical fertilizers at 3% and 5% level. Then water was given continuously to the treated seeds up to 15 days in twice a day to maintain the relative humidity. When performing this experiment proper care was taken and maintains the entire physical factor in laboratory.

Treatment after seed germination: After one week of experimentation when seeds start to germinate similar concentration of applied chemical fertilizer was given to the seeds. Water was given twice a day up to total span of experimentation. Some morphological changing was also recorded periodically in the treated seed.

Results and discussion

Different chemical fertilizers tested at 3% and 5% level resulted in maximum germination percentage within 4 days (Figure-1 a,b). 100% germination has been recorded in urea at 3% level followed by potash (80%) in comparison to control (80%) after 15 days. DAP favoured better result at 5% level and it showed 100% germination. 98% germination has been recorded under

the treatment of potash at both 3% and 5% concentration. Urea at 3% level increased the germination percentage. But application of urea has strongly inhibitory effect on the rate of seed germination and root elongation of Chinese cabbage[6]. When germination got initiated, radicle and plumule growth were noticed to be highly influenced by the applied chemical fertilizers. Maximum length of plumule (70mm) was recorded under the treatment of urea at 3% level followed by U+D+P (65mm) in comparison to control (Figure-2a,b). Mixture of urea, DAP and potash (U+D+P) at 3% level enhanced radicle length and it was noticed highest (45mm) in comparison to control (30mm).

Phosphorus can influence fruiting developments of different crops and it regarded as key of life because it is directly and indirectly involved in vital process of plant[7]. Phosphorus is also a key constituent of ATP which transforms energy to the plant. It take part in various physiological process and helps in nutrients uptake by promoting root growth and their by ensuring a good pod yield[8].

In comparison of 3% concentration for different applied chemical fertilizer, 5% proved slightly less effective in augmenting the plumule and radicle length. After 15 days, maximum plumule length (50mm) was recorded under DAP concentration which is followed by urea (42mm) in comparison to the control (52mm) (Figure-3). In this respect recommended the use of an optimal rate of 70 kg/ha of pure nitrogen or an integrated system involve in the combined use of somewhat lower mineral fertilizer rates and farmyard manure[9]. Fresh and dry matter production of radicle and plumule is highly stimulated by urea and DAP at 3% and 5% level in comparison to other treatment (Table-1).

Maximum fresh weight (.0218±0.9mg) of plumule has been recorded in urea at 3% concentration which is followed by U+D+P 0.189±.06mg in comparison of control 0.172±.o5. Dry weight of plumule has been recorded in same order at 3% concentration (0.142±.04mg urea, 0.124±.03mg U+D+P and 120mg control). At 5% concentration DAP was found more effective to increase the fresh weight of plumule and maximum (0.185±.06) fresh weight of plumule has been noticed (Figure-4 a,b). Among plant nutrient nitrogen, phosphorus and potash influences vegetative and reproductive phase of crops[10].

It may be due to highest percentage of nitrogen having more availability of salt like nitrate, potash and phosphate which significantly increasing growth rate of plant. Manure plays a vital role in chlorophyll, protein, nucleic acid, hormones and vitamin synthesis. It also helps in cell division, cell elongation and linear increase in green pod yield of Okra[11]. But use of chemical fertilizers for a long time has resulted in poor soil health; reduce in production and enhance the disease and pest infestation[12]. Application of chemical fertilizers help to overcome the nutrient deficiencies but excess use of these chemical fertilizers reduced the soil fertility by changing soil pH.

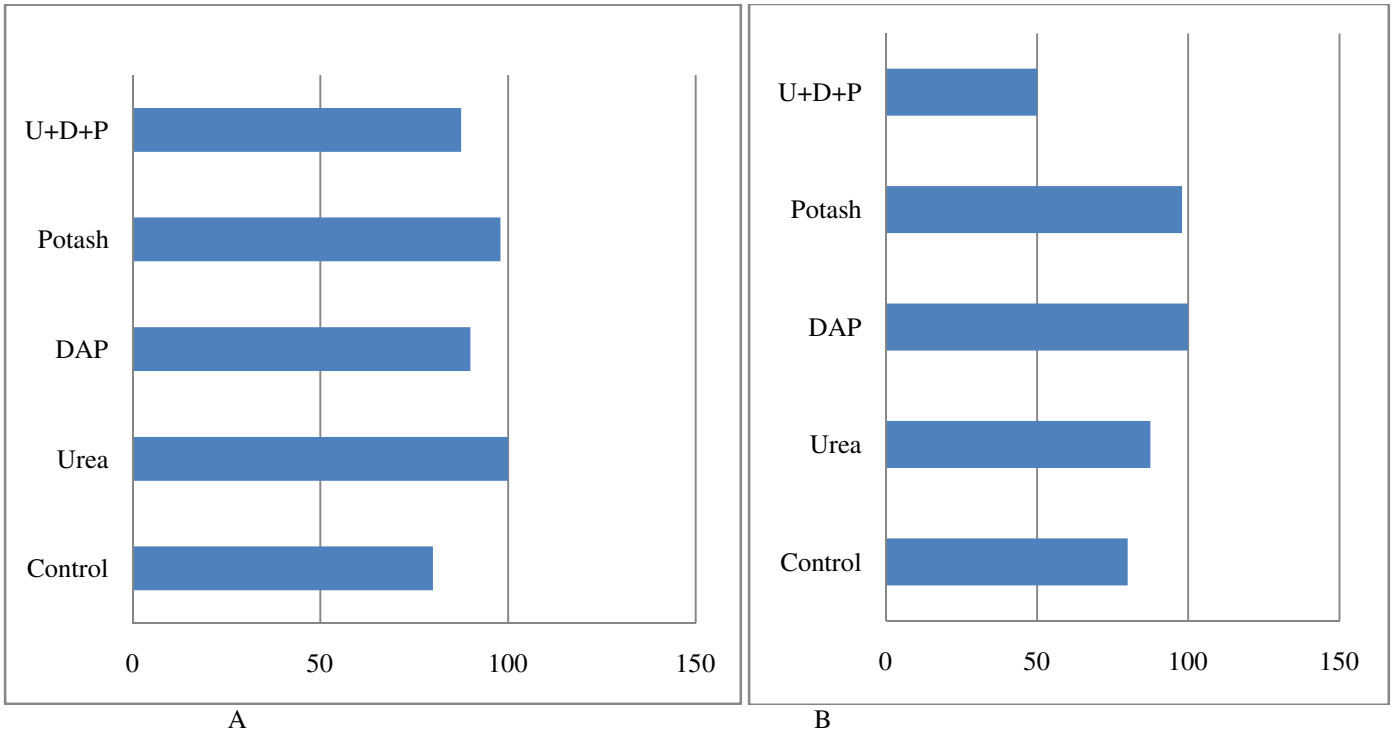

Figure-1: (a) Influence of different chemical fertilizers on germination %age of maize seed at 3% level after 15 days. (b) Influence of different chemical fertilizers on germination %age of maize seed at 5% level after 15 days.

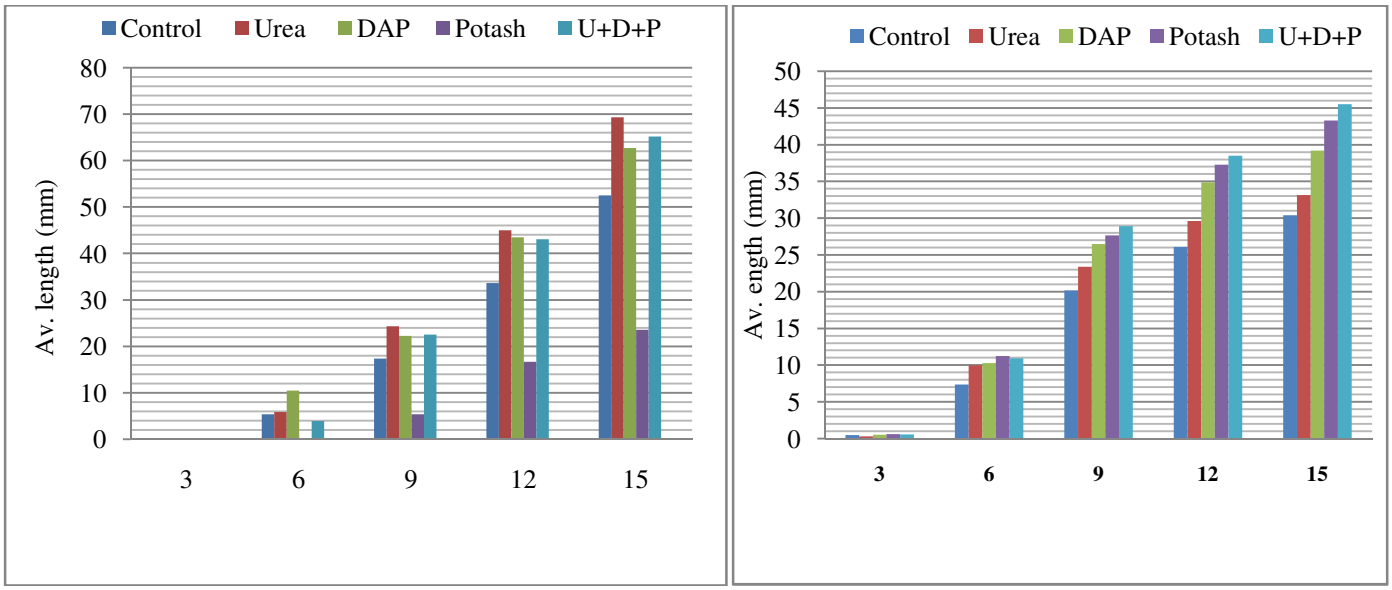

Figure-2: (a) Effects of different chemical fertilizers and their mixture on plumule length (cm) at 3% level after 15 days. (b) Effects of different chemical fertilizers and their mixture on radicle length (cm) at 3% level after 15 days.

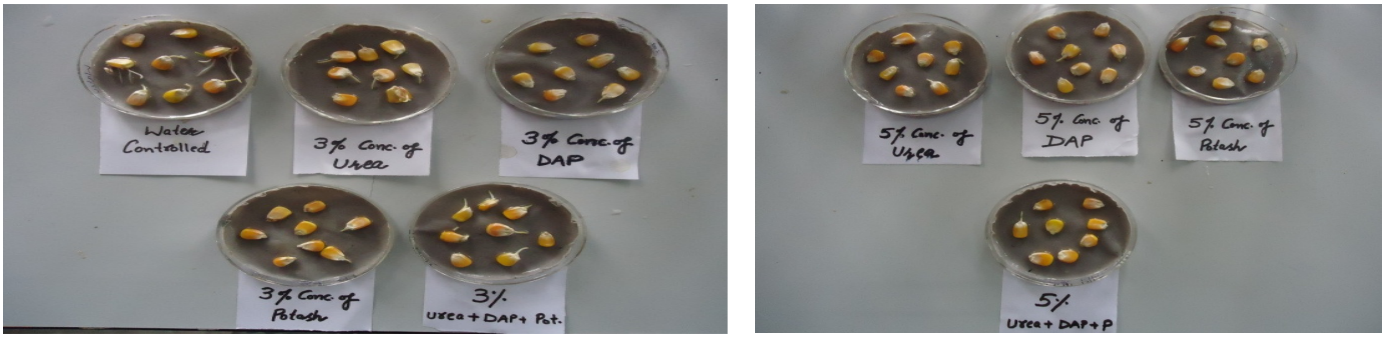

Figure-3: Influence of different chemical fertilizers on seed germination and seedling growth of maize after 4 days of experimentation.

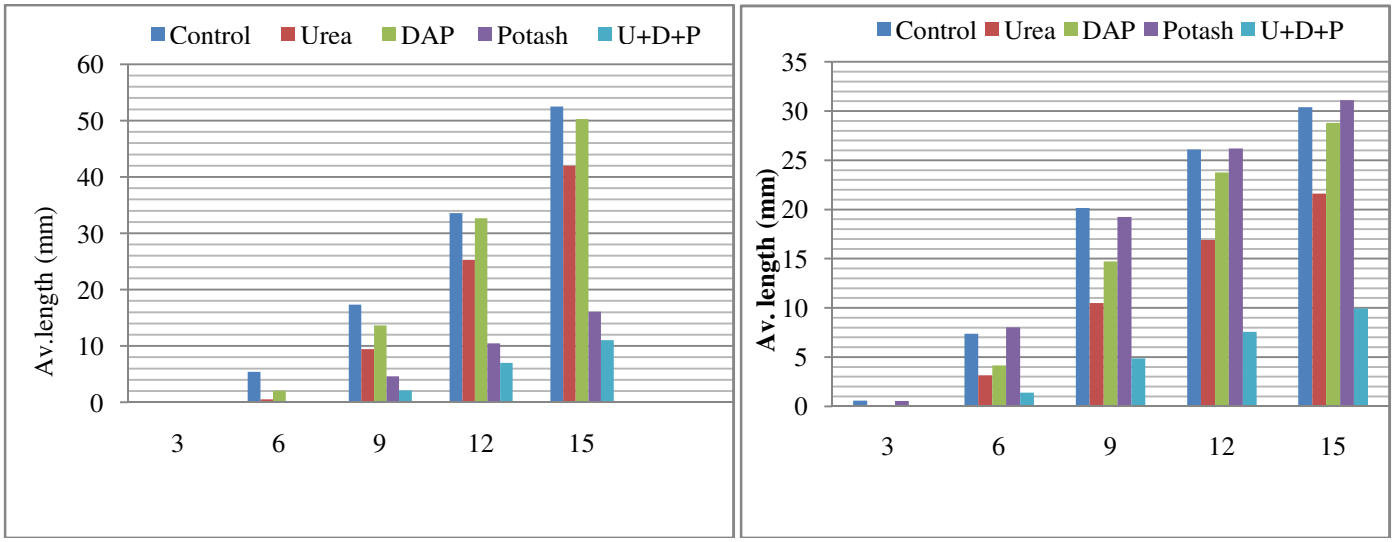

Figure-4: (a) Effects of different chemical fertilizers and their mixture on plumule length (cm) at 5% level after 15 days. (b) Effects of different chemical fertilizers and their mixture on radicle length (cm) at 5% level after 15 days.

Table-1: Av. dry wt. and fresh wt. of plumule and radicale of maize after 16 days.

Replicate (At 3% level)	Plumule		Radicle	
	Fresh weight (mg)	Dry weight (mg)	Fresh weight (mg)	Dry weight (mg)
Control	0.172±.o5	0.80±.02	0.135±.02	0.95±.004
Urea	0.218±.09	0.142±.04	0.156±.03	0.81±.005
DAP	0.179±.06	0.93±.03	0.128±.02	0.76±.002
Potash	0.133±.003	0.72±.04	0.152±.03	0.77±.004
U+D+P	0.189±.06	0.84±.03	0.144±.03	0.68±.003
(At 5% level)				
Control	0.163±.05	0.86±.03	0.127±.03	0.87±.003
Urea	0.126±.03	0.75±.003	0.144±.04	0.82±.03
DAP	0.185±.06	0.84±.03	0.145±.04	0.63±.02
Potash	0.159±.04	0.61±.02	0.137±.03	0.81±.02
U+D+P	0.124±.02	0.53±.003	0.151±.04	0.95±.02
± SE of means				

Conclusion

The fertilizers used in this study had a significant effect on different parameters. Seed germination and seedling growth of maize obtained upon applied treatment with higher concentration was non-significantly than lower concentration. The results obtained suggest that lower concentration of nitrogen, potash and DAP rates can be successfully used in the maize production and to greater inputs enhancing growth rate of different crops. However chemical fertilizers needs could be substitute by introducing organic fertilizer, these organic fertilizers helps in increasing crop production without affecting soil fertility.

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