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EFFECT OF TITANIUM DIOXIDE NANOFERTILIZER ON SEED GERMINATION AND GERMINATION INDICES IN ONION (PREMA 178)

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ABSTRACT

Nanoparticle is a microscopic particle with at least 1 dimension less than 1000 nm .TiO_2 nanoparticles are known for photo catalytic activity , high stability and low cost . They are ecofriendly and found to be safe for all living thing. These particles have been used in pathogen treatment decomposition of phytotoxic compound .Integrated nutrient management strategies involving chemical and biological fertilizer is a real challenge to stop using the high rates of agrochemical and to enhance sustainability of crop production. In present investigation different concentration (0.02M-0.1M)of TiO2 NPs were prepared in distilled water and use for treatment in Onion seeds to study their effect on seed germination. Result indicates that TiO_2 NPs at lower concentration enhances seed germination, promptness index, and seedling growth. These result point out the possible use of TiO_2 NPs in onion to promote seed germination and early seedling growth to have healthy and study seedling stack for plantation in the field.

Keywords- *Nanoparticle,, Nanofertilizer, Titanium Dioxide, seed germination etc.*

INTRODUCTION

In modern agriculture, due to heavy usage of chemical fertilizers and harmful pesticides on the crops, they decrease the nutritive value and soil fertile. But Nano fertilizer have alternative to chemical fertilizer due to their eco-friendly photo-catalytic, non-toxic, high stability and low cost nature. effect of Nano and biological fertilizers on carbohydrate and chlorophyll it show that Nano fertilizer had significant effect on chlorophyll , carotenoid and carbohydrate .Nano particle is a microscopic particle with at least one dimension less than 1000nm (Rasker and Laware,2013). Metal Nano-particle appears in different shape such as Nano-powder, Nano-cluster or Nano-crystal and different size ranging from 2nm -100nm. in protection of environment ,nanotechnology is finding ,application in photo-catalysis .a process in which light promotes a reaction between compound such as pesticide reduce and Nano-material without the later being consumed. In food safety photo-catalysis could find uses in cleansing the surface of fresh fruits and vegetable with toxic agrochemical residue and in-destroying bacteria on such produce . The biocide properties (antifungal and antibacterial) of the Nano-particles have significant particle relevance and can be tapped to control the bacterial and fungal organism responsible for crop losses. TiO_2 is used in antiseptic which can not only inhibit reproduction ability of bacterium. TiO_2 is a non-dissolved material which does not dissolve itself when degrade organic contaminant and kill germs.TiO_2 becomes transparent of the nanoscale(particle size < 100nm)& is able to absorb and reflect UV light maing it useful in sunscreens. TiO_2 are

used because of theirbhigh stability, anticorrosive character and photocatalysis. TiO_2 can produce free radical with a strong oxidizing ability which can catalyse DNA damage both invitro and in human cell.

MATERIAL AND METHODS

Titanium dioxide (TiO_2) powder of particle purity>99.0%and impurity>0.10% was obtained from chemist in the field of nanomaterial synthesis. The molecular weight of TiO_2 is 79.90. Seed of local Onion variety PREMA 178 was procured from East-West seeds India pvt. Ltd., narayanpur (Bk), Post-Walunj, Tal-Gangapur, Dist-Aurangabad (M.S.).

(1).Effect Of Nanoparticles On Seed Germination:

The graded concentration (00, 0.02M, 0.04M, 0.06M, 0.08Mand 0.1M) of TiO_2 nanoparticles prepared in distilled water.The soil bed method are used.Using a single bed for each treatment and 30 seed per bed in seed germination treatment. in each concentration of nanoparticles. Similar experiment without nanoparticles was conducted as control. After 15 days of treatment, germinated seeds are calculated. Seedlings were selected randomly and separated into shoots roots. Seedling growth in terms of root length, shoot length, fresh weight and dry weight were recorded. Results were compared to see effect of nanoparticles on seed germination and early seedling growth.

(2).Seed Germination Indices:

Parameters like Promptness index (PI), Germination percentage (G %), Germinationspeed (GS), Germination index (GI), Mean germination time (MGT), Vigorindex (VI).

(a) Promptness index(PI) = nd2(1.0)+nd4(0.75)+nd6(0.5)nd8(0.25)
Where n is the no. of seed germinated at day "d"
(b) Germination percentage(G%) = no. of seed germinated/total no. of seed ×100
(c) Germination speed(GS) = n1/d1+n2/d2+n3/d3+……..+nn/dn.
(d) Mean germination time(MGT) = n1×d1+n2×d2+n3×d3+……. +nn ×dn/total no. of days.
(e) Vigor index -I(VI-I) = seedling length(cm)× germination percentage
(f) Vigor index –II(VI-II) = seedling dry weight× germination percentage

(3). Seedling Growth Stress Indices:

(a) Germination stress tolerance index (GSI) = PI of stressed seeds/PI of control seeds×100
(b) Plant height stress tolerance index (PHSI) = plant height of stressed seedlings/plant height of control seedlings×100.
(c) Root length stress tolerance index (RLSI) = Root length of stressed seedling/Root length of control seedlings×100
(d) Dry matter stress tolerance index (DMSI) = Dry matter of stressed plant/Dry matter of control plant ×100.

(e) Fresh matter stress tolerance index (FMSI) = Fresh matter of stressed plant /Fresh matter of control plant ×100.

RESULT

Result belong to seed germination and early seedling growth clearly indicate that TiO_2 NP,s promote seed germination and seedling growth from 0.04M up to 0.1M; however at 0.02M concentration of TiO_2 NPs a significant decrease in seed germination was observed. The lower concentration reduces seed germination and seedling growth, but at higher concentration promoted seed germination. The concentration 0.04M of TiO_2 NPs showed high germination percentage i.e.96.66%, 0.02M of TiO_2 NPs showed low germination percentage i.e. 6.66%.

At 0.06M and0.1M concentration of NPs shows decreased seedling height and at 0.04Mand0.08M concentration of TiO_2 NPs shows increased seedling height. Data with respect to the PI clearly shows that PI increases in0.04M to 0.1M concentration of Tio_2 NPs and decreased significantly both in 0.02M and 0.08Mconcentration of TiO_2 NPs. Germination stress tolerance index (GSI) indicates speed of seed germination if control and treated seedling higher GSI of 0.04M , 0.06M and 0.1M(141.30,124.45 and 111.41 respectively)was exhibited by above concentration of TiO_2 NPs and lower GSI 7.06 and 94.56 was observed in 0.02M and 0.08M TiO_2 NPs treatment. Plant height stress tolerance index (PHSI) value showed conversely sudden and significant decrease in PHSI value 64.51 and 61.46 is very less value in 0.06M and 0.1M concentration of TiO_2 NPs.

DISCUSSION

Seed germination result indicate that TiO_2 NPs at lower concentration enhances seed germination, promptness index and seedling growth. These results point out the possible use of TiO_2 NPs in onion to promote seed germination and early seedling growth to have healthy and sturdy seedling stock for plantation in the field (1). In present investigation different concentration (00,10,20,30,40ug/ml) of ZnO NPs were prepared in distilled water and for the treatment in onion seeds to study the effect on cell division , seed germination and early seedling growth. Decreased mitotic index (MI) and increase in chromosomal abnormalities were observed in higher treatment of ZnO NPs. Seed germination increased in lower concentration , however showed decrease in value of higher concentration germination indices showed decrease values in lower concentration, however these decreased significantly of higher concentration (2).

The result showed that nanofertilizers had significant effect on chlorophyll a, chlorophyll b,carotenoid in sorghum plant (3). The result shows that TiO_2 NPs on onion at lower concentration enhances seed germination, promptness index and seedling growth. Result indicates that lower concentrations are not harmful to the seed germination and early seedling growth.

Table 1: Effect of Tio2 nanoparticles on seed germination of cotton seeds:

Concentration of Tio2 NPs(M)	Germination Percentage(G%)	Germination speed(GS)	Germination Index (GI)	Mean germination time(MGT)	Vigor Index-I	Promptness index(PI)	Plant length(cm)	GSI	PHSI
A (0.02M)	6.66%	0.43	0.43	3	219.97	16.25	4.5	7.06	76.40
B (0.04M)	96.66%	8.6	8.6	54.66	459.1	325	4.75	141.30	80.64
C (0.06M)	83.33%	7.7	7.7	47.66	316.6	286.25	3.8	124.45	64.51
D (0.08M)	70%	5.8	5.8	37.33	339.5	217.5	4.85	94.56	82.34
E (0.1M)	80%	6.8	6.8	43.66	289.6	256.25	3.62	111.41	61.46
Control	63.33%	36.5	36.5	37.33	373	230	5.89	100	100
mean	66.66	5.97	5.97	37.27	301.29	221.87	4.5	96.46	77.55
S.D.	31.55	2.88	2.28	18.03	145.24	107.88	0.818	46.95	62.07
S.E.	12.88	1.177	1.177	7.36	59.30	44.05	0.33	19.17	14.16

Seed germination result indicate that TiO_2 NPs at lower concentration enhances seed germination, promptness index and seedling growth. These results point out the possible use of TiO_2 NPs in onion to promote seed germination and early seedling growth

CONCLUSION

Result show that TiO_2 NPs at higher concentration enhance seed germination, PI, and seedling growth. Result indicates that higher concentrations are not harmful to the seed germination and early seedling growth to have healthy and sturdy seedling stock for plantation in the field.

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