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Original Research Article

# EFFECT OF $Ca(H_2PO_4)_2$ ON *AZOLLA*

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**Abstract** Ca $(H_2PO_4)_2$ is a chemical fertilizer, commercially known as superphosphate and commonly known as bone-ash and usually sold in open market for agriculture purposes. Whatever, whenever, wherever and whensoever phosphate fertilizer is given to the standing crop only 20% of phosphate is taken up and utilized by the crop and the rest 80% is remain suspended in the soil, unless until the microbial activity is not interacting with the suspended phosphate parties. Especially microbes, lower algae and *Azolla* have the capacity to utilize this suspended phosphate particles through their metabolic activity. Different species of *Azolla*, distilled water, Natural Pond water and superphosphate were taken to the laboratory and successive observations were noted from 1st June (2014) upto May 31st (2015) and again from 1st June (2015) up to May 31st (2016).

**Keywords:-***Azolla*, superphosphate, Bio fertilizer, Pinnata, Prostrata, Erecta.

**Introduction:** *Azolla* is a photo, thermo and Chemo sensitive aquatic fern and highly selective by nature, its symbiotic relationship makes it unique. It is a good quality fish food and it may be used up as a fodder in poultry, animal husbandry and piggery also. It grows vigorously in polluted pond, ditches and in lentic water bodies, where $P^H$ of water varies from 3 to 5 or ranging Between 3 to 5. During the course of investigation, it was noted that four different species of Azolla are available at Patna. *Azolla* Belongs to *Azollaceae*, Salviniales and leptosporangiate fern. Commonly *Azolla*is known as duckweed, mosquito fern, feathered water fern, water volvate or velvate fern and ferry moss, *Azolla* needs lentic polluted water bodies where it grows vigorously as free floating bulk at aquatic weed. Plant body is delicate and differentiated into Rhizoids, stem and leaves. It measures 1 to 3 cm long and 1 to 2 cm wide in adult condition. According to clark (1980) and Armstrong (1985) *Azolla* reduces evaporation of water bodies. *Azolla* is a promising green manure which maintain C/N ratio of soil.

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**Material & Methods:-** *Azolla* plants, pond water, Distil water, Borosil glass Beaker, glass tub, glass rod, globes for safety, superphosphate

at least one pocket for successive experimentations for observations and electronic Balance are needed. Only *Azolla*filiculoids and *Azolla*pinnata were taken into considerations but prostrate and eracta needs moisture soil, different water tubes for polluted pond water and similar number of tubs of distilled water were placed near window where Variegated sunlight were available 2g/L 3g/L, 4g/L and 5g/L super phosphate were weighed twice one for pond water and other for distil water then weighed superphosphate were put into tubes and steered total mass very well then weighed *Azolla* mass similar weighed *Azolla* plant were put into different tubs for comparative study and careful observation.

**Observation**

| | | | | | |
|---|---|---|---|---|---|
| (1) | Colour of Plant | Filiculaids<br>Brick Red | Pinnata<br>green | Prostrata<br>Soil Brown | Erecta<br>P. green |
| (2) | Odour of plant and adjoin water also | Fishy | Green | Soil like | – |
| (3) | Required $P^H$ - | 3-4 | 3-5 | 3-5 | 4-5 |
| (4) | Required Temperature | $5^0$c to $40^0$c | $25^0$c to $30^0$c | $5^0$c to $15^0$c | $5^0$c to $10^0$c |

**Meteorological data**

| **Month** | **Temperature Minimum – Maximum** | | **Humidity Lower -** | **Higher** | **Rain fall** |
|---|---|---|---|---|---|
| January | $5^0$c | $12^0$c | 70. | 90. | 10 mm. |
| February | $10^0$c | $18^0$c | 62. | 75. | 0 mm. |
| March | $20^0$c | $25^0$c | 40. | 50. | 0 mm. |
| April | $32^0$c | $40^0$c | 38. | 52. | 0 mm. |
| May | $33^0$c | $40^0$c | 30. | 50. | 15 mm. |
| June | $32^0$c | $41^0$c | 40. | 55. | 58 mm. |
| July | $30^0$c | $39^0$c | 62. | 79. | 60 mm. |
| August | $35^0$c | $40^0$c | 80. | 92. | 500 mm. |
| September | $29^0$c | $35^0$c | 90. | 100. | 100 mm. |
| October | $24^0$c | $35^0$c | 85. | 100. | 300 mm. |
| November | $12^0$c | $22^0$c | 72. | 100. | 30 mm. |
| December | $10^0$c | $18^0$c | 60. | 98. | 15 mm. |

**Available of Azolla Species.**

| Months | Filiculoids | Pinnata | Prostrata | Erecta |
|---|---|---|---|---|
| January | +++ | + | +++ | + |
| February | +++ | + | _ | _ |
| March | +++ | + | _ | _ |
| April | ++ | _ | _ | _ |
| May | + | _ | _ | _ |
| June | _ | _ | _ | _ |
| July | _ | _ | _ | _ |
| August | + | _ | _ | _ |
| September | +++ | ++ | _ | _ |
| October | +++ | +++ | _ | _ |
| November | +++ | +++ | + | ++ |
| December | +++ | +++ | +++ | +++ |

(+ present) (++ more) (+++ Abundant) (- absent)
More or less similar result were observed in (12-13 and 13-14).

**In Laboratory condition form 1st June (2014) to 31 May 2015.**

| Month | Pond Water | | | | | Filiculoids with distilWater | | | | | Pond water | | | | | Pinnata with distil water | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1g/L | 2g/L | 3g/L | 4g/L | 5g/L | 1g/L | 2g/L | 3g/L | 4g/L | 5g/L | 1g/L | 2g/L | 3g/L | 4g/L | 5g/L | 1g/L | 2g/L | 3g/L | 4g/L | 5g/L |
| June | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| July | 5 | 9 | 10 | 10 | 21 | 3 | 3 | 5 | 5 | 11 | 4 | 5 | 11 | 20 | 24 | 2 | 3 | 3 | 3 | 7 |
| Aug | 9 | 15 | 21 | 30 | 45 | 4 | 3.5 | 7 | 12 | 17 | 10 | 11 | 27 | 42 | 51 | 3 | 3 | 3 | 6 | 11 |
| Sep | 14 | 28 | 33 | 63 | 72 | 5 | 6 | 10 | 17 | 25 | 27 | 33 | 39 | 69 | 75 | 3 | 4 | 5 | 9 | 17 |
| Oct | 22 | 36 | 51 | 81 | 86 | 5 | 10 | 10 | 26 | 29 | 39 | 42 | 49 | 82 | 90 | 3 | 4 | 7 | 13 | 25 |
| Nov | 35 | 51 | 66 | 96 | 124 | 7 | 10 | 17 | 29 | 37 | 40 | 47 | 57 | 96 | 117 | 4 | 5 | 9 | 17 | 25 |
| Dec | 35 | 65 | 80 | 135 | 155 | 7 | 10 | 17 | 35 | 41 | 47 | 53 | 81 | 121 | 150 | 6 | 6 | 9 | 19 | 26 |
| Jan | 42 | 77 | 96 | 163 | 176 | 7 | 14 | 22 | 37 | 43 | 51 | 57 | 99 | 141 | 179 | 6 | 6 | 9 | 21 | 27 |
| Feb | 45 | 90 | 115 | 172 | 205 | 7 | 17 | 27 | 37 | 47 | 56 | 68 | 121 | 161 | 211 | 7 | 7 | 11 | 21 | 29 |
| Mar | 48 | 92 | 135 | 185 | 235 | 8 | 17 | 27 | 39 | 49 | 56 | 81 | 140 | 170 | 235 | 8 | 9 | 13 | 21 | 29 |
| Apr | 48 | 97 | 146 | 194 | 244 | 9 | 17 | 30 | 40 | 50 | 59 | 85 | 149 | 178 | 249 | 8 | 10 | 13 | 21 | 30 |
| May | 50 | 99 | 149 | 201 | 250 | 10 | 19 | 30 | 41 | 50 | 60 | 90 | 151 | 180 | 253 | 8 | 11 | 14 | 22 | 30 |

**In Laboratory condition form 1st June (2015) to 31 May 2016.**

| Month | Pond Water | | | | | Filiculoids with distil Water | | | | | Pond water | | | | | Pinnata with distil water | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1g/L | 2g/L | 3g/L | 4g/L | 5g/L | 1g/L | 2g/L | 3g/L | 4g/L | 5g/L | 1g/L | 2g/L | 3g/L | 4g/L | 5g/L | 1g/L | 2g/L | 3g/L | 4g/L | 5g/L |
| June | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| July | 4 | 8 | 10 | 9 | 20 | 5 | 3 | 5 | 8 | 15 | 4 | 5 | 15 | 20 | 25 | 2 | 3 | 3 | 5 | 8 |
| Aug | 8 | 15 | 20 | 28 | 40 | 8 | 5 | 8 | 15 | 19 | 10 | 15 | 20 | 40 | 50 | 3 | 8 | 10 | 15 | 20 |
| Sep | 15 | 30 | 35 | 60 | 75 | 10 | 8 | 12 | 20 | 25 | 25 | 30 | 35 | 60 | 75 | 3 | 8 | 12 | 20 | 20 |
| Oct | 20 | 36 | 50 | 80 | 80 | 10 | 10 | 10 | 20 | 25 | 30 | 40 | 40 | 80 | 90 | 5 | 5 | 15 | 15 | 25 |
| Nov | 35 | 50 | 60 | 90 | 120 | 12 | 10 | 15 | 26 | 30 | 35 | 42 | 50 | 90 | 100 | 7 | 10 | 15 | 18 | 25 |
| Dec | 35 | 60 | 70 | 125 | 150 | 12 | 15 | 15 | 30 | 35 | 40 | 50 | 80 | 120 | 120 | 8 | 10 | 10 | 20 | 25 |
| Jan | 42 | 70 | 85 | 143 | 175 | 15 | 15 | 20 | 35 | 40 | 50 | 50 | 90 | 140 | 125 | 8 | 10 | 10 | 20 | 30 |
| Feb | 45 | 90 | 100 | 152 | 200 | 12 | 18 | 25 | 35 | 45 | 50 | 68 | 120 | 160 | 210 | 9 | 12 | 15 | 20 | 35 |
| Mar | 40 | 90 | 125 | 165 | 225 | 20 | 18 | 25 | 40 | 45 | 55 | 80 | 125 | 175 | 230 | 10 | 12 | 15 | 20 | 35 |
| Apr | 35 | 75 | 136 | 180 | 240 | 22 | 20 | 30 | 45 | 50 | 55 | 85 | 130 | 175 | 245 | 10 | 15 | 15 | 25 | 35 |
| May | 30 | 35 | 145 | 200 | 250 | 25 | 25 | 35 | 45 | 50 | 60 | 90 | 135 | 180 | 250 | 10 | 15 | 15 | 25 | 35 |

**Discussions:–** Similar observations were showing that the growth of *Azolla* depends upon the basis of pollution load into the water bodies Pandey and Thakur (2000) observed in polluted drainage system Thakur and Srivastava (1986) reported Fern in north Bihar. Again Pandey&thakur studied it from (2011 up to & up till now.) In Himachal, In Panjab University and also in Maharashtra it is studied since last decade. Pillai *et al.* (2014), Ahmad (1941) on A filiculoids, Lumpkin *et al.* (1980) worked on manure and economic importance, Janes, (1998) worked on Growth and survival of Azollafiliculoides. Moore, A. W. (1969) worked on Azolla: Biology and agronomic significance. *Sjodin, Erik (2012 worked on The Azolla Cooking and cultivation Project. Wagner, G.M. (1997). Worked on Azolla: a review of its biology and utilization.* Hussner, A. (2006 worked on *Online Database of the North European and Baltic Network on Invasive Alien Species.* Hackney, P. (Ed) 1992 worked on studied Filiculoids in Cool Conditions.

**Conclusions: –** The observations are showing that the filiculoids are more tolerant species, to pollution load and more sensitive through the *Azolla* to the standing crop will have no any side effect and the produced crop yield will be the result of organic farming it is already known that *Azolla*is maintaining C/N ration of soil and soil health, so the direct use of chemical fertilizer should be avoided and through *Azolla* Culture, it will be the more beneficial to all.

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