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IMPACT OF DIFFERENT WATER OF VALSAD DISTRICT ON GROWTH AND DEVELOPMENT OF DARBH GRASS (*Desmostachya bipinnata* L.) DURING WINTER SEASON

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ABSTRACT

Darbh grass (*Desmostachya bipinnata* L.) is herbaceous, perennial, rhizomatous grass and is a member of the family Poaceae or Gramineae. Darbh grass has vital medicinal value and this grass is widely used as traditional medicine by traditional people to cure many diseases. The present study describes the impact of four sources of water on the growth and development of Darbh grass at Valsad city, Gujarat, Bharat. The sources of water were: Wanki River, Auranga River, Ghadoi River, and Tap water of Valsad city. The present study was monitored for a period of one month (for 30 days) in the winter season. The water samples were analysed by Total Dissolved Solids (TDS), pH, Dissolved Oxygen (DO), Hardness, Alkalinity, and Chloride (Cl) parameters. During this study, differences in plant height and root length were observed between 30 days before and 30 days after. This study shows that the Auranga River water was not competent for the growth of Darbh grass.

Keywords: Darbh grass (*Desmostachya bipinnata*), Growth of plant, River and Tap water, Water parameters, Winter season

INTRODUCTION

Plants that have one or more of its elements having substances that can be used for treatment of diseases, are known as "Medicinal Plants" **[1]**. These medicinal plants are used as medicine as well as food or perfume too. Also, it is used in some

particular spiritual activities **[2]**. As because of zero or minimal side effects, the treatment with this medicinal plant is considered to be safer than other treatments. That's why medicinal drugs are more significant to the health of individuals and community. So, Due to these reasons, the popularity of herbal remedies has increased all over the world **[3]**. *Desmostachya bipinnata* (L.) Pers. is such kind of species which can be utilised as medicinal plants. *Desmostachya bipinnata* (L.) commonly known as Darbh grass or Kusha grass and it is a member of the family Poaceae or Gramineae. It grows commonly and opulently in waste land of agricultural fields, in company of roadsides and on borders and bank of agricultural fields on arid and gritty soils **[4]**. *Desmostachya bipinnata* (L.) is herbaceous, perennial, rhizomatous and tall tufted grass. It is a C_4 grass and occur in desert or semi-desert condition. This grass have salt and drought tolerant capacity. This grass produced by seed and vegetative reproduction **[5]**. Darbh grass medicinally used in dysentery, asthma, diarrhoea, jaundice, vaginal discharges, burning sensation, bleeding piles, etc. It showed antidiarrheal, anticancer and antiulcer activity **[6]**. *Desmostachya bipinnata* (L.) has been considered a sacred grass and has been used in religious rituals since Vedic times **[7]**.

For the present work, water used from three rivers and tap water of Valsad city of Gujarat for the growth and development of Darbh grass. Valsad city also known as 'Bulsar'. Valsad District is located in south area of Gujarat near the Arabian Sea in the west. Water used from three rivers of Valsad city, these three rivers includes Wanki, Auranga and Ghadoi River. In this study, it was seen that what effects of river water and tap water are occurring on the growth and development of Darbh grass. It was also observed that in which water growth of Darbh grass maximum in terms of plant height (shoot length) and root length. TDS, pH, DO, Hardness, Alkalinity and Cl were used for the measurement of water.

TDS (Total Dissolve Solids) measure various salts that have been dissolved in water. High level of salts in water can certainly be problem for plant life that affect many aspect of plant growth. It is measured in mg/L **[8]**. High pH condition will increase the overall health of the plants and under low pH condition most plant eventually die **[9]**. DO (Dissolved oxygen) is simply the quantity of oxygen dissolved in water. Plants need the right amount of dissolved oxygen in the water to survive. DO is measured in mg/L **[10]**. Hardness refers to the quantity of Calcium and Magnesium existing in water and both of these elements are essential for the

growth of the plant. Hardness is measured in mg/L of $CaCO_3$ or ppm of $CaCO_3$ **[11]**. Alkalinity refers to measure water's capacity to neutralize acidity. Alkalinity measured the level of Carbonates, Bicarbonates and Hydroxide of water sample. It is measured in ppm of Calcium carbonate ($CaCO_3$) **[12]** .Cl (Chloride) have direct toxic effect on plant. It is measured in mg/L or ppm **[13]**.

MATERIALS AND METHODS

Measuring plant growth

Specifically, plant growth and water parameters (TDS, pH, DO, Hardness, Alkalinity and Cl) were measured to compared different river water and tap water for growing *Desmostachya bipinnata* (L.) plant in 30 days in Valsad city during winter season. Water used in this study were collected from Wanki, Auranga and Ghadoi River and Tap water of Valsad City. Wanki River located near Vashiyar village, Auranga River located near Hanumanbhagda Village and Ghadoi River located near Ghadoi village. Tap water collected from home. Small sized plants of *Desmostachya bipinnata* (L.), planting pots, potting soil and a measuring device for dispensing water were used. Soil was purchased from the nursery, so that the soil condition for every plant is the same. Ten plants were planted in each pots and gave the pots name as A, B, C and D. The A pot was watered by Wanki river water; second B pot was watered by Auranga river water; third C pot was watered by Ghadoi river water and forth D pot was watered by Tap water of Valsad City.

It is ensured that the plants were not exposed to rain so that the exact kind and amount of water can be used to grow the plants. It was also important to keep all of the other growth conditions constant like sun exposure, the soil and temperature. Then monitor the plants for 30 days. After 30 days, measured the plant height in centimetre from the base of the stem to the shoot apex or to the leaf apex. After 30 days, measured the plant's root length in centimetre. For this measurement, first plant was uprooted and washed off to remove any loose soil and then root length was measured.

Determination of water parameters

Collected river water and tap water samples were used for the measurement of TDS, pH, DO, Hardness, Alkalinity and Cl.

Total Dissolved Solids: TDS meter was used for the measurement of Total Dissolved Solids. Each sample was measured twice, then average values were calculated.

pH: pH meter was used for the measurement of pH of water samples. Each sample was measured twice, then average values were calculated.

Dissolved Oxygen: Dissolve Oxygen of water sample was determined by Winkler method or Azide modification method **[14]**.

Procedure: 300 ml glass BOD bottle (Biological Oxygen Demand bottle) was taken and filled up with water sample. Add two ml of manganese sulphate immediately to the BOD bottle by injecting the pipette just below the surface of the solution. Add 2 ml reagent alkali – iodide – azide in the same way. Cover the bottle with carefulness to be sure no air is introduced. Mix the sample by turn upside down bottle numerous times. So, a brownish orange precipitates were formed. To dissolve the precipitates of BOD bottle, add 2 ml of concentrated Sulphuric acid (H_2SO_4). Take 250 ml glass flask and add 100 ml sample from the BOD bottle and 2 ml Starch solution. So, a blue colour forms. These sample titrate with Sodium thiosulphate solution. Continue slowly titrating until the blue sample turns clear. The concentration of dissolved oxygen in the sample in mg/L is equivalent to the number of millilitres of titrant used.

Hardness: Hardness of sample water was determined by EDTA Titrimetric Method **[14]**.

Procedure: Take clean and dry 250 ml conical flask and add 25 ml water sample. Then add 25 ml distilled water and shake well. Add 2 ml buffer solution and 1 drop Eriocrome Black T (EBT) indicator and shake well. So, a pink colour forms. These sample titrate with EDTA (Ethylenediamine tetraacetic acid) solution from burette. Continue titrating until pink colour starts to change light blue or light green. Standardize EDTA titrant and established reagent blank value by the titration method outlined above. The concentration of hardness in sample water is estimated in mg/L of $CaCO_3$ (Calcium carbonate).

Alkalinity: Alkalinity of water sample was determined by Titration Method **[14]**.

Procedure: For alkalinity measurement first we have to measure pH value of water sample. If the pH value is higher than 8.3, in that case we have to titrate the sample in two session: 1) Phenolphthalein titration, 2) Mixed indicator titration. If the pH value is lower than 8.3, in that case we have to do only the second titration by using mixed indicator. (If the water is alkaline then adding an indicator makes the solution pink in colour. But if the water is neutral then adding indicator does not cause pink colour. So in such case do not add burette sample and start direct second session).

1) Phenolphthalein titration: Take dry and clean 250 ml conical flask and add 20 ml water sample. Then add few drop of indicator phenolphthalein solution and shake well. So, a pink colour forms. These

sample titrate with 0.02 N H_2SO_4 (Sulphuric acid) solution from Burette. Continue titrating until pink colour sample turns clear. Note the final burette reading of the first session.

2) Mixed indicator titration: Add some drops of mixed indicator solution to the same flask and shake well. No colour developed in solution. These sample titrate with 0.02 N H_2SO_4 solution from Burette. Continue titrating until faint pink colour forms. Note the final burette reading of the second session.

Chloride: Chloride (Cl) of water sample was determine by Argentrometric Method **[14]**.

Procedure: Take sample water bottle and shake well and check pH of water sample. pH of water sample must be in between 7 to 10, if not adjust pH by 1 N HCl (Hydrochloric acid) or 1 N Sodium hydroxide (NaOH). Take dry and clean 250 ml conical flask and add 50 ml water sample. Add 1 ml indicator Potassium chromate and shake well. So, a transparent yellow colour forms. These sample titrate with $AgNO_3$ (Silver nitrate) solution from burette. Continue titrating until transparent yellow colour starts to change yellowish brown colour. Standardize $AgNO_3$ (Silver nitrate) titrant and established reagent blank value by the titration method outlined above.

RESULT AND DISCUSSION

Plant growth, TDS, pH, DO, Hardness, Alkalinity, Cl were measured to compared different river water and tap water to growing *Desmostachya bipinnata* (L.) plant in 30 days.

Plant growth analysis

As shown in **Table 1 and Figure 1**, in winter season, after 30 days height of *Desmostachya bipinnata* (L.) plant for Wanki River was 38.5 cm, Auranga River was 33.5 cm and Ghadoi River was 43.5 cm where a plant height for Tap water was 46 cm. Root length of *Desmostachya bipinnata* (L.) plant for Wanki River, Auranga River and Ghadoi River were 8 cm, 7.5 cm and 8 cm respectively. Where a root length of plant for Tap water was 4 cm.

In winter season, highest growth of plant shows in Tap water sample **(Table 1)**. Among three River (Wanki, Auranga and Ghadoi River) highest growth of plant shown in Ghadoi River water. Highest growth of plant root shows in Wanki River and Tap water sample **(Table 1)**. The plants grown up by Auranga River water were dried and so of yellow in colour. From thirty days, in the early days the plants were seen to grow in Pots – A, C and D while in the last days the plants dried and turned yellow. However, no growth of the

plant was observed in Auranga River water giving pot – B.

Water sample analysis

An analysis of river water and tap water samples which were taken from rivers Wanki, Auranga and Ghadoi of Valsad city was done by Total Dissolved Solids (TDS), pH and DO, Hardness, Alkalinity, Chloride (Cl) parameters so that we could understand the importance of river water and tap water for the growth of *Desmostachya bipinnata* (L.) plant.

Table 1: Reports on plant height and root length of *Desmostachya bipinnata* (L.) during winter season

Pots	Water sample	Winter season *Desmostachya bipinnata* (L.) growth			
		Plant height (cm)		Root length (cm)	
		At initial stage	After 30 days	At initial stage	After 30 days
A	Wanki	36	38.5	5	8
B	Auranga	33.5	33.5	7.5	7.5
C	Ghadoi	38.5	43.5	8	8
D	Tap water	33.5	46	2.5	4

Abbreviation: cm – centimetre

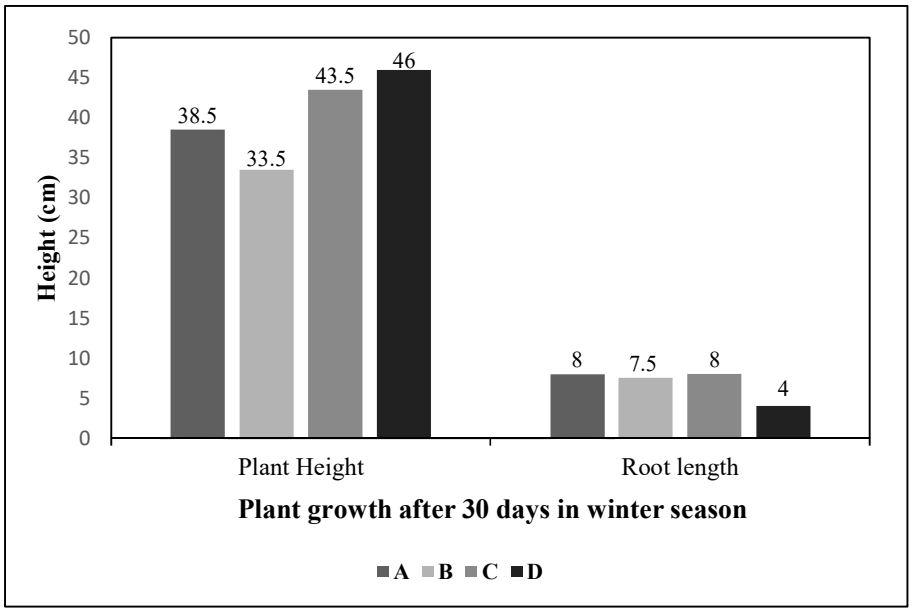

Figure 1: Plant height and root length of *Desmostachya bipinnata* (L.) after 30 days in winter season
A – Wanki River Water, B – Auranga River Water, C – Ghadoi River Water, D – Tap Water

Table 2: Reports on TDS, pH, DO, Hardness, Alkalinity, Chlorides of water samples during Winter season

Water Samples	Winter season					
	TDS (mg/L)	pH	DO (mg/L)	Hardness (mg/L of $CaCO_3$)	Alkalinity (mg/L of $CaCO_3$)	Cl (mg/L)
Wanki River	430	7.2	8.9	232	297	193.3
Auranga River	745	6.4	3.8	3800	277.2	21028
Ghadoi River	185	7.6	7.2	94	113.8	47.25
Tap water	346	6.8	9.2	116	163.3	18.8

Abbreviation: TDS – Total Dissolved Solids, DO – Dissolved Oxygen, Cl – Chlorides, $CaCO_3$ – Calcium carbonate

As shown in **Table 2**, in winter season, TDS of Wanki, Auranga and Ghadoi River were 430, 745 and 185 mg/L where a TDS of Tap water was 346 mg/L. pH of Wanki River was 7.2, Auranga River was 6.4 and Ghadoi River was 7.6 where a pH of Tap water was 6.8. DO of Wanki River was 8.9 mg/L, Auranga River was 3.8 mg/L and Ghadoi River was 7.2 mg/L where a DO of Tap water was 9.2 mg/L. Hardness of Wanki, Auranga and Ghadoi River were 232, 3800 and 94 mg/L of $CaCO_3$ where a Hardness of Tap water was 116 mg/L of $CaCO_3$. Alkalinity of Wanki, Auranga and Ghadoi River water were 297, 277.2 and 113.8 mg/L of $CaCO_3$ where a Tap water was 163.3 mg/L of $CaCO_3$. Chloride of Wanki River water was 193.3 mg/L, Auranga River water was 21028 mg/L and Ghadoi River water was 47.25 mg/L where a Chloride of Tap water was 18.8 mg/L.

The river water and tap water used in present study were derived from the Wanki, Auranga and Ghadoi River and Tap water of Valsad city, Gujarat, Bharat. Total Dissolved Solids stands for the total dissolved substances which could be salts and / or minerals in water. High level of salts in water can certainly be problem for plant life that affect many aspect of plant growth. If the pH and TDS of the water supplied to the plant is too high for the soil then it is difficult to get other important nutrients from the plant roots **[15]**. Highest TDS measuring sample was Auranga River that is 745 mg/L (Pot - B) and lowest TDS measuring sample was Ghadoi River that is 185 mg /L. TDS of Tap water was 346 mg/L **(Table 2)**.

pH condition between 5.0 to 6.5 is widely accepted for successful plant growth. Low pH condition (Acidic pH) will decrease the overall health of the plants. Plants have certain abnormal characteristics that are affected by low pH levels. Plants affected by acidic soil conditions exhibit retarded growth. Also, the leaves of plants turn yellow or brown, and most plants eventually die because of overexposure to low pH. High pH condition (Alkaline pH) will increase the overall health of the plants **[9]**. As shown by **Table 2**, in winter season lowest pH containing sample was Auranga River that is 6.4 and highest pH containing sample was Ghadoi River that is 7.6. pH of Tap water was 6.8.

The quantity of oxygen dissolved in water is called dissolved oxygen. It is an essential indicator of water quality. Essential quantity of dissolved oxygen in water is required for the plant to survive. The capacity of cold water to retain dissolved oxygen is better than that of hot water. The capacity of fresh water to retain dissolved oxygen is better than that of salt

water. Low level of Dissolve Oxygen reduce plant growth and high level of Dissolve Oxygen promote plant growth **[14]**. As shown in **Table 2**, in winter season Highest DO measuring sample was Wanki River that is 8.9 mg/L and Lowest DO measuring sample was Auranga River that is 3.8 mg/L. DO of Tap water was 9.2 mg/L.

Hardness is the amount of Calcium and Magnesium in water. Iron, Manganese and Sulphur are also found in less amount in water. Both Ca and Mg elements are essential for the growth of plants. Water with more hardness (called Hard water – 180 and up mg/L of $CaCO_3$) accumulates salt around the roots of plant so that the plant cannot get other essential nutrients from the water. So the plant does not get the nutrients it needs for growth and eventually the plant dies. Water becomes hard due to the appearance of an excess of Calcium, Magnesium, Manganese, Iron and Sulphur **[11]**. As shown in **Table 2**, in winter season Highest Hardness measuring sample was Auranga River water that is 3800 mg/L of $CaCO_3$ and Lowest Hardness measuring sample was Ghadoi River water that is 94 mg/L of $CaCO_3$. Hardness of Tap water was 116 mg/L of $CaCO_3$.

Alkalinity test determined the levels of Carbonates, Bicarbonates and hydroxide in water. Alkalinity not only regulates pH but also removes toxic metals from the water. Levels among 30 to 60 mg/L of $CaCO_3$ is considered best for almost plants **[12]**. As shown in **Table 2**, in winter season Highest Alkalinity measuring sample was Wanki River water that is 297 mg/L of $CaCO_3$ and Lowest Alkalinity measuring sample was Ghadoi River water that is 113.8 mg/L of $CaCO_3$. Alkalinity of Tap water was 163.3 mg/L of $CaCO_3$.

Plant water that comes from rivers, streams, private wells and ponds has a greater proportion of Chloride. Although Cl are essential for plant growth, excess Cl have a direct toxic effect on plants. If there is too much Cl in the water given to the plant, water cannot be absorbed by the roots, so the growth in the plant is reduced and eventually the plant dies **[13]**. As shown in **Table 2**, in winter season Highest Chloride measuring sample was Auranga River water that is 21,028 mg/L and Lowest Chloride measuring sample was Ghadoi River water that is 47.25 mg/L. Chloride of Tap water was 18.8 mg/L.

CONCLUSION

There were significance differences in plant height. Darbh grass which was grown by Ghadoi River water and Tap water showed good growth. While the growth of Darbh grass grown by the water of Auranga River was not observed. It can therefore be concluded that Auranga River water was not suitable for the growth of Darbh grass.

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