

## **Net Assimilation Rate (NAR) and Relative Growth Rate (RGR) of different potato cultivars**

**ADESH KUMAR AND V.K. BHATNAGAR**

*Dept. of Botany, Hindu College, Moradabad*

### **Abstract**

*The Experimental site was selected at TMIMT farm house road Pakwara, Moradabad and Plant Physiology lab Department of Botany Hindu College Moradabad U.P. Net Assimilation Rate and Relative growth Rate of different varieties of potato are culture at various stages (45-60 days) and (60-75 days) during 2018-19, 19-2020,  $V_2$  (K. Badshah) is higher than other varieties. At second stage (2019-20) of Net Assimilation rate  $V_9$  (45-60 days) and  $V_3$  (60-70 days) are higher than other varieties. Growth and the physiological parameters are known to be directly related with the yield of tubers. NAR and RGR of a plant at on instant in time (T) is defined as the increase of plant material per unit of assimilatory material per unit of time.*

Keywords: Net Assimilation Rate, Relative growth Rate, physiological parameters

### **Introduction**

Potato (*Solanum tuberosum* L.) is one of the most important and unique crops among vegetable in the sense that it can supplement the food needs in the country in a very substantial measure. It is one of the short duration crops which can be fitted in any intensive crop rotation and gives the higher yield per unit time and area. It also gives more average dry matter, calories, carbohydrate and protein per unit area than cereals. Potato is an annual herbaceous plant belonging to the family Solanaceae. The potato is third most important food crop in world other rice and wheat in term of Human consumption.

The potato is not an outstanding source of energy but it is a very good source of high-quality protein. This is of considerable importance in a developing country like India where energy supplies are more readily available than protein supplies. One of the major objectives of potato research is the evaluation of potato varieties/ cultures suited for different agro- climate regions of the country with respect to growth, maturity, yield, tuber quality and resistance to well know disease and insect pests.

Several hybrid varieties at Central Potato Research institute, Shimla, have been released for

commercial cultivation in the country. However, the need of the present day is to find out suitable cultures which are resistant to diseases and insect pest and better than the present-day culture from qualitative viewpoints. Thus, the evaluation of the cultures which are superior in all respect than the present varieties. Twenty-one amino acids present in the human body. Our of these eleven can be synthesized by the human body itself. The remaining ten amino acids which cannot be synthesized by the human body are called essential amino acids. Human beings have to take these essential amino acids through their food to meet the body's requirements. When the essential amino acids are not taken in sufficient quantity, growth and development are retarded. The advantage that potato has over other cereal staples is its high Lysine content. The Lysine content in potatoes is similar to that in a typical animal protein. With its high lysine content, potato can supplement diets which are limping in lysine. For example, rice with accompanying potato provides a better protein.

Anand, K. Chipsona-1 and K. Sindhuri. Morphological and qualitative trails and resistance to various disease and insects-pest of these varieties

have not been searched out various disease and insect –pest of these varieties have not been searched out so far.

It is the forwarded tuber crop of the world both in terms of area covered and production. About fifty percent of the total production of root and tubers in the world. Nutritionally, potato is a balanced food with regard to ratio of protein, essential vitamins, minerals, trace elements and percentage of little fat (Gopalan et al., 1972). Biological value is 73 percent for potato as compared to 54 rice and 53 for wheat (Chang and Avery. 1969) potato is a whole some article in addition to diet for human being. It can easily be converted in sun dried and processed article of food.

In developing countries, potato was 100 million tonnes with an average growth rate of 4.5% in area in the nineties of 20<sup>th</sup> century. In India, compared to the production, area and yield of potato in 1949-50, the increase over the same period was 461% 547% and 267% (SGPC.2008) respectively (Amon, 1986). According to the latest provisional FAO data, potato production worldwide stands at 329 million tones and cover more than 19 million hectares area. China is now the world largest potato produce (75 million tonnes) followed by Russian federation (37 million tonnes) and Indian (23.12 million tonnes) expanded in developing countries as the growth rate for area planted and production continue to accelerate. Obviously, most remarkable is that potato output still continues to Recently India contribution about 1542.3-thousand-hectare area along with 29188.6 thousand tones production and 179.20 q/ha productivity infect Uttar Pradesh ranked first in area, production in productivity followed by 440-thousand-hectare area, 9821 thousand tones production in 233.2 q/ha productivity respectively. (N.H.B. Gurgaon, 2004-05).

Yield and dry matter are controlled by photosynthesis, while photosynthesis is affected by leaf area, leaf area index, leaf area, ratio, chlorophyll, content and other environment factors. Hence, the factors limiting the total yield may be due to the lack of development of leaf area, photosynthesis system and other environmental factors.

Increase in yield contributing attributes totally depending upon the performance of

photosynthesis activities going in the plant system. However, two Columbian scientists Lopez and Felipe (1977) recorded relatively higher RGR values and showed that RGR-T reached maximum of 0.89 g/g tuber at 56 days in Parda Pastusa and 209.4 g/s tuber at 126 days in ICA Narino.

Narendra and Zakwan (2008) studies the RGR and found K. Chandramukhi had higher emergence 92.6% height 19.6 cm haulm cutting stage 91.4cm. Higher plant height of K. Chandramukhi. 91 cm followed K. Jyoti Singh et.al., (2009) studied growth and post-harvest are most important for obtaining potatoes suitable for processing in extreme cold conditions of northern plains were not suitable. Purohit and Malhotra (1972) did not find and definite pattern of variation in NAR of potato varieties with time grown at Patna and Jalandhar.

Mehrotra et al., (1976) also recorded highest NAR values absorbing capacity of a clone with a LAI of 3.0 and a diffuse leaf canopy should be more effective in light absorption than a weak prostrate vine.

Purohit and Malhotra (1972) studied the relative growth of two potato varieties under two agro-climatic conditions. After tuber initiation RGR at early stages was higher in both varieties K. Sindhuri and K. Chandramukhi and then declined with time. Bremmer and Radley (1966), Collins (1977) and Perunal (1981) Katiygr et al., 2000, observed wide variation with respect to T.S.S. and ascorbic acid content in cultivar 6.1% in K. Sutlej and following 4.90 in K. Bahar also reported decline in RGR with time. Purohit et al. (1973) recorded that RGR- tuber and RGR- leaf in variety K. Chandramukhi varied from 0.0238 to 0.50442 and 0.01562, respectively.

RGR of tuber and whole plant was been found highest between 33 and 44 days after plating and then decreased in the potato varieties. K. Chandramukhi, K. Lauvkar, K. Kuber, K. Alankar, K. Sinduri and K. Jyoti (Ezekiel and Marti, 1977 and Coilins, 1977).

## Results and Discussion

The Data in (Table 1 and 2) on RGR of potato cultures reveal that the cultures different significantly at both stages during both year. A

personal of table 1 indicates that only few cultures showed higher RGR at first stage while it was higher in others at second stage. At First stage V<sub>2</sub> attained higher RGR followed by V<sub>9</sub> and V<sub>10</sub> while V<sub>5</sub> followed by V<sub>1</sub> and V<sub>4</sub> showed lesser RGR at this stage. At 60-75 days stage, the increase in RGR was observed in most of the cultures, being highest in V<sub>2</sub> followed by V<sub>6</sub> and V<sub>7</sub> while it was poorest in V<sub>1</sub> followed by V<sub>5</sub> and V<sub>4</sub>.

During second year (Table 2), over all relatively lesser RGR was recorded in all cultures/ varieties than first year at both the stages. At first stage i.e. 45-60 days the highest RGR was recorded in V<sub>2</sub> followed by V<sub>6</sub> and V<sub>7</sub> while it was lowest in V<sub>1</sub> followed by V<sub>5</sub> and V<sub>8</sub>.

*Net Assimilation Rate*

Data presented in table 3 and 4 indicate that culture/varieties were significantly different in both the year with respect of the NAR. It would be observed from the table 3 that NAR reached higher in V<sub>2</sub> and V<sub>8</sub> at first stage while in others at 60-75 days stage. At later stage, reduction in NAR was observed only in V<sub>2</sub> and V<sub>9</sub>. At second stage V<sub>7</sub> and V<sub>3</sub> showed highest NAR followed by V<sub>2</sub> and V<sub>9</sub> while it was poorest at this stage in V<sub>10</sub> and V<sub>5</sub>.

During the second year (Table 4) NAR was higher in most of the cultures/ varieties except V<sub>10</sub>. At first stage NAR was observed to be highest in V<sub>9</sub> followed by V<sub>7</sub> and V<sub>2</sub> while V<sub>10</sub> was poorest.

Table 1: Relative growth rate (g/g/day) of potato cultures/ varieties at various stages during 2018-19

Cultures	Symbol	Days after planting	
		45-60	60-75
K. Navtal	V <sub>1</sub>	0.008	0.006
K. Badshah	V <sub>2</sub>	0.092	0.087
K. Bahar	V <sub>3</sub>	0.032	0.041
K. Chandramukhi	V <sub>4</sub>	0.015	0.016
K. Himani	V <sub>5</sub>	0.006	0.014
K. Jyoti	V <sub>6</sub>	0.041	0.082
K. Lalima	V <sub>7</sub>	0.037	0.046
K. Anand	V <sub>8</sub>	0.022	0.038
K. Sindhuri	V <sub>9</sub>	0.046	0.042
K. Chipsona-1	V <sub>10</sub>	0.043	0.036
'F' Test C.D. at 5%		0.005	0.004

Table 2: Relative growth rate (g/g/day) of potato cultures/ varieties at various stages during 2019-20

Cultures	Symbol	Days after planting	
		45-60	60-75
K. Navtal	V <sub>1</sub>	0.007	0.047
K. Badshah	V <sub>2</sub>	0.081	0.097
K. Bahar	V <sub>3</sub>	0.027	0.041
K. Chandramukhi	V <sub>4</sub>	0.014	0.040
K. Himani	V <sub>5</sub>	0.007	0.014
K. Jyoti	V <sub>6</sub>	0.041	0.054
K. Lalima	V <sub>7</sub>	0.041	0.007
K. Anand	V <sub>8</sub>	0.007	0.034
K. Sindhuri	V <sub>9</sub>	0.021	0.027
K. Chipsona-1	V <sub>10</sub>	0.041	0.007
'F' Test C.D. at 5%		0.004	0.003

Table 3: Relative growth rate (g/dm<sup>2</sup>/day) of potato cultures/ varieties at various stages during 2018-19

Cultures	Symbol	Days after planting	
		45-60	60-75
K. Navtal	V <sub>1</sub>	0.012	0.014
K. Badshah	V <sub>2</sub>	0.028	0.029
K. Bahar	V <sub>3</sub>	0.012	0.022
K. Chandramukhi	V <sub>4</sub>	0.009	0.013
K. Himani	V <sub>5</sub>	0.009	0.009
K. Jyoti	V <sub>6</sub>	0.011	0.013
K. Lalima	V <sub>7</sub>	0.018	0.028
K. Anand	V <sub>8</sub>	0.010	0.012
K. Sindhuri	V <sub>9</sub>	0.021	0.019
K. Chipsona-1	V <sub>10</sub>	0.009	0.010
'F' Test C.D. at 5%		0.005	0.006

At second stage V<sub>3</sub> showed highest NAR followed by V<sub>2</sub> and V<sub>7</sub> while it was poorest in V<sub>10</sub> and V<sub>2</sub>.

**Conclusion**

During the first year RGR and NAR in general were lower at the first stage and then increased at second stage the second year. These growth parameters were higher at first stage even when the leaf Area index as low kufri Badshah showed higher RGR and NAR at first stage during both years. But the values were quite low in kufri-

Table 4: Relative growth rate (g/dm<sup>2</sup>/day) of potato cultures/varieties at various stages during 2019-20

Cultures	Symbol	Days after planting	
		45-60	60-75
K. Navtal	V <sub>1</sub>	0.012	0.016
K. Badshah	V <sub>2</sub>	0.027	0.028
K. Bahar	V <sub>3</sub>	0.019	0.036
K. Chandramukhi	V <sub>4</sub>	0.009	0.016
K. Himani	V <sub>5</sub>	0.010	0.017
K. Jyoti	V <sub>6</sub>	0.016	0.019
K. Lalima	V <sub>7</sub>	0.029	0.027
K. Anand	V <sub>8</sub>	0.010	0.017
K. Sindhuri	V <sub>9</sub>	0.032	0.026
K. Chipsona-1	V <sub>10</sub>	0.009	0.010
'F' Test C.D. at 5%		0.004	0.005

chandramukhi. Significant variation among the varieties in respect of these character were noted in both years. Purohit and Malhotra (1972) found variation in RGR and NAR with respect at varieties and location. In kufri-chandramukhi under Jalandhar condition NAR increase till 28-35 days and subsequently decreased whereas under Patna condition it remained almost constant till 49 days and increased to higher level b/w 49 to 56 days after planting with a sharp fall. Kufri Sindhuri showed peaks b/w 35-42 and 63 to 70 days were observed under Patna conditions.

### References

- Annon (1986). Annual Report. All India coordinated potato important project. Kalyani 1985-86, 46p.
- Bremer J.M. and Radley, R.W. (1966). Studies in potato agronomy. The effect of variety, seed size and spacing on growth, development and yield. *Jou. Agric. Sci.* 66: 241-262.
- Chang Y.P. and Avery E.E. (1966). Nutritive value of potato v/s rice protein *J. am Diet Assoc.* 55: 565-586.
- Collin, W.B. (1977). Growth in Netted Gem Potato as influenced by transplanting and by green sprouting, *Am- Potato J-54*: 339353.
- Ezekiel, R and Murti, G.R. (1977). Growth of potato varieties under varying environmental Conditions *Ann. Sci. report C.P.R.I. Simla*, pp 26-27.
- Gopalan, C.; Ramasastri, B.V. and Bulasubramaniam (1972) Nutritive value of Indian foods, *National Institute Hyderabad*.
- Katiyar, Hariom; Singh N.P. and Manoj Raghav (2000). Evaluation of potato cultivars for processing and storage. *Progressive horticulture 32(2)*: 167-171.
- Lopez, J.G. and Felipe, A.L. (1977). Comparison of the leaf of growth of cultivars of potato (*Solanum tuberosum* L. Sub sp. antigens) on the high plateau of Pasto. C.F. fld. *Crops Abstr*; 3:1036.
- Mehrotra O.N.; Saxena, H.K.; Ram, R.S. and Kumar, J. (1976). *Photosynthetic system and plant Productivity Horticulture 7* :5-14.
- Narendra Singh and Zakuran Ahmed (2008). Effect of mulching on potato production in high attitude cold arid zone of Ladhak. *Potato J.35 (3-4)* : 118-121.
- Perumal, N.K. (1981). Influence of date of planting on growth, development and yield of potato *J. root crops*, 7. 33-36.
- Purohit, A.N. and Malhotra, V.P. (1972). Relative growth rates of tuber and leaf of potato varieties under two agro- climate conditions *Indian J.Pl. physical*, 16:89-99.
- Purohit A.N.; Banerjee, V.N. and Malhotra, V.P. (1973). Growth analysis and photosynthetic efficiency of the potato. *Sci. report C.P.R.I for the triennium 1971-83*, pp 59-61.
- Singh, R.K.; Jyotsana Sharma; G.K. Singh and S.P. Trehan (2009). Effect of soil solarization of multiplication of in vitro planting material of potato under field condition. *Potato J. 36 (3-4)*: 143148.