Iranian Journal of Field Crops Research
Vol. 15, No. 1, Spring. 2017, p. 136-149

نشریه پژوهشهای زراعی ایران
جلد ۱۵، شماره ۱، بهار ۱۳۹۶، ص. ۱۴۹-۱۳۶

Radiation Absorption and Use Efficiency of Common Mallow (*Malva sylvestris* L.) Affected by Different Sources of Organic, Biological and Chemical Fertilizers and Intercropping with Fenugreek (*Trigonella foenum-graecum*)

S. A. R. Razavi[1]- M. Jahan[2*]- M. Nassiri Mahallati[3]- K. Hajmohammad nia Ghalibaf[4]

Received: 26-06-2015
Accepted: 07-02-2016

Introduction

Over one billion people, mostly in developing countries, use medicinal plants for the whole life or some part of it or at least prefer them to the synthetic drugs. According to a study of World Bank, trade in medicinal plants will have a share of over 5$ trillion in global trade in 2050. Growing population during last century and the demand for harvesting medicinal plants from natural areas, particularly those which commonly used, endangered these species with the risk of extinction. Common Mallow (*Malva sylvestris* L.) is a medicinal plant commonly used as a natural remedy and other industries e.g. cosmetic industry. On the other hand, negative impacts of synthetic agricultural inputs on human health, the need for producing healthy commodities, replacing chemical agricultural inputs with some environmental friendly ones, and paying attention to new concepts like sustainability, lead agroecologists to introduce ecologically alternatives to farmers, in order to be replaced with chemical fertilizers. Using Plant growth Promoting Rhizobacteria (PGPR) and fungi symbiotic with many vascular plants, is one of these alternatives. Mechanistic crop growth analysis including radiation absorption and use efficiency was compiled in agricultural researches from 1950, farther than classical analysis. Thus, the goal of this experiment is to evaluate radiation absorption and use efficiency of Common Mallow under the effect of different sources of biological, chemical and organic fertilizers and intercropping with Fenugreek (*Trigonellafoenum-graecum*).

Materials and Methods

The experiment was conducted as a split plot design based on RCBD with three replications at the research farm of Ferdowsi University of Mashhad during the growing season of 2013. The main plot factor had two levels: 1-application of cattle manure and 2-no application of cattle manure, and the sub plot factor had seven levels as: 1- Nitroxin®, 2-Sulphur solubilizing bacteria (SSB) 3-Phosphate solubilizing bacteria (PSB), 4- Nitroxin + SSB + PSB, 5- Chemical fertilizer, 6-Row intercropping with Fenugreek, and 7- Control. Inoculation of seeds with boifertilizers done in standard situation recommended by their producers and the CFU of all biofertilizers were more than 10^8. On 25 of March, 25 ton.ha^{-1} of cattle manure distributed by hand in needed plots. The sowing operation was done on March 30.The total area of a plot was 12 square meters and the distance between and on the rows were 50 and 20 cm, respectively. Leaf area index, dry matter and the radiation above, and transmitted through, the canopy measured each 14 days (with a Linear Septometer, SunScan, Delta T Co., UK). Then the total radiation absorption for each plot was calculated by the relevant equations. Finally, radiation use efficiency is estimated with measuring the slope of the regression line between cumulative absorbed radiation and dry matter of the plant.

Results and Discussion

The results showed that application of cattle manure increased LAI, particularly in the early stages of Common Mallow growth, and the highest level of LAI was on the treatment of "Nitroxin + SSB + PSB + Cattle manure" and "Chemical fertilizer + cattle manure" with 2.49 and 2.37, respectively. This is while, in the absence of cattle manure, chemical fertilizer had more effect on increasing LAI compared to the biofretilizers. Application of cattle manure also reduced the light extinction coefficient (K) of the plant, while "Nitroxin + SSB + PSB + Cattle manure" treatment had the least K value (K=0.47, R2=0.98). ANOVA results showed all experimental treatments had a significant effect ($P\leq 0.001$) on the cumulative absorbed radiation of Mallow during the growing season. The most accumulated absorbed radiation occurred under Nitroxin + SSB + PSB treatment (by mean of 986.6 MJ.m^{-2}), while application and no-application of cattle manure had no significant

1, 2, 3 and 4- Ph.D. Student, Associate Proffessor, Proffessor and Assistant professor Respectively, Department of Agronomy and Plants Breeding, Ferdowsi University of Mashhad
(*- Corresponding Author Email: jahan@um.ac.ir)

effect on radiation absorption. The total calculated mean of RUE was 1.26 g.MJ^{-1}. Nitroxin inoculation resulted in the least RUE (1.09 g.MJ-1) and Nitroxin + SSB + PSB inoculation plus cattle manure application had the highest RUE (1.5 g.MJ^{-1}).

Conclusions

Generally, according to the goals of the experiment which were comparing some ecological inputs with chemical fertilizer from the point of mechanistic crop growth analysis factors such as radiation absorption and RUE, it seems that mixture of the three biological fertilizers of Nitroxin + SSB + PSB plus application of cattle manure can compete with chemical nitrogen fertilizer in such factors.

Keywords: Azospirillum, Azotobacter, Cattle manure, Light extinction coefficient, Pseudomonas