

**ENERGY BALANCE COMPONENTS IN LOW LAND RICE IN TELANGANA REGION OF ANDHRA PRADESH****G. Sreenivas, G. Pranuthi, D. Raji Reddy and B.K. Bhattacharya**Agromet-Cell, Agricultural Research Institute, Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad, India  
gsreenivas2002@yahoo.co.in, pranuthimsc@gmail.com, drreddy001@yahoo.com, bkbhattacharya@sac.isro.gov.in**KEYWORDS:** Bowen Ratio, Energy Balance Components, Net radiation, Sensible Heat Flux, Latent Heat Flux.**ABSTRACT:**

Plants have the unique ability to convert the incoming flux of solar energy into useful dry matter, in the form of food, fodder or biofuel. Available net radiation is mainly partitioned into latent heat (*LE*), sensible heat (*H*) and ground heat (*G*). Bowen ratio is the ratio of sensible and latent heat fluxes. Data collected from the field experiment conducted at Regional Agricultural Research Station, Jagtial during *Rabi* 2008-09 was used in the study. Bowen ratio (*B*), Net radiation (*R<sub>n</sub>*), Sensible heat flux (*H*) and Latent heat flux (*LE*) was computed using actual vapor pressure and temperature and latent heat flux was computed using Bowen ratio. Results revealed that, among different phenophases of rice lower Bowen ratio (0.63) was observed during panicle initiation followed by heading (0.654) and maturity (0.751). Higher *LE* component of energy balance indicates the higher biomass production of rice during *Rabi* season.

**1. INTRODUCTION**

Rice (*Oryza Sativa* L.) is the major staple food for a large proportion of world's population. On an average, rice accounts for 27 percent of all cereal food grain production (Wayne Smith 1995). Asia accounts for about 90 percent of the world's rice area and production. Rice, the most important crop of India, is grown on area of 44.88 M ha with annual production of 87.37 lakh tonnes with productivity of 1947 Kg.ha<sup>-1</sup>. In Andhra Pradesh it is cultivated on an area about 4.19 M ha with annual production of 116.8 lakh tonnes with productivity of 2782 kg.ha<sup>-1</sup> ([http://drdpat.bih.nic.in/PA-Table-01-Andhra Pradesh.htm](http://drdpat.bih.nic.in/PA-Table-01-Andhra%20Pradesh.htm)). Solar radiation plays a vital role in plant growth, development and production. Plants are the efficient biological converters of solar energy into biomass. Radiation defines the yield of a crop in particular region. Net radiation is partitioned into three components namely ground/soil heat flux which is the transfer of sensible heat in the soil towards the surface or away from the surface (negligible, assumed to be zero in the paddy field as it is grown in puddled soils), Sensible heat flux which is the process where heat is transferred from the Earth's surface to the atmosphere by conduction and convection, Latent heat flux moves energy when solid and liquid water are converted into vapour (also called Latent heat of evaporation). These are the important components which decide the productivity of a crop. Hence, an attempt has been made to study the energy balance components of puddled rice in this paper

**2. MATERIALS AND METHODS**

A field experiment was conducted during *rabi-2008* at Polasa farm, RARS Jagtial, Andhra Pradesh. The study site is situated at 18°50'18.1" N Latitude 78°56'47.7" E longitude with an altitude of 248.4 m above MSL. The *rabi* crop was sown on 21.12.2009, transplanted on 21.01.2009 and harvested on 4.5.2009. The crop was raised adopting recommended package of practices for rice in the region. The weather parameters above the crop canopy was recorded at two heights i.e., at 10 and 50 cm above the canopy at different stages of the crop. The dates for collection of the weather parameters over the crop were fixed in such a way that they would

coincide with the Intensive Observation Periods (IOP) of the AWiFS satellite pass over the region. Weather parameters like temperature, relative humidity, dewpoint temperature are recorded using *Kestrel* 4000 portable weather tracker. Two weather trackers are arranged above the crop at two heights with similar date and time are set such that they record the data at every one hour interval from 9.00 to 16.00 hrs IST. The difference between *R<sub>n</sub>* and *G* is the energy transported upward by Sensible Heat (*H*) and Latent Energy (*LE*). The Bowen-ratio ( $\beta$ ) is the ratio of *H* to *LE* (Bowen, 1926).  $\beta$  is also a function of the heat capacity and density of air and vapor pressure (Monteith and Unsworth, 1990). These energy balance components and Bowen ratio were computed using the methodology suggested in FAO Irrigation and Drainage Paper No. 56.

**3. RESULTS AND DISCUSSION****3.1 Variation of Bowen Ratio**

The Bowen ratio represents the sharing of the residual energy between sensible heat transfer to the atmosphere and latent heat. During the crop growth period Bowen ratio at physiological maturity (PM) was maximum (0.751) compared to other stages and minimum (0.183) in case of the just transplanted crop (Table.1).

IOP Dates	Stage of the Crop	R <sub>n</sub>	Br	LE	H
23 <sup>rd</sup> Jan	Transplanting	8.23	0.183	6.96	1.272
3 <sup>rd</sup> Mar	PI (Panicle Initiation)	10.80	0.631	6.62	4.181
4 <sup>th</sup> Apr	HD (Heading)	12.18	0.654	7.36	4.816
28 <sup>th</sup> Apr	PM (Physiological Maturity)	11.68	0.751	6.67	5.010

Table 1: Net Radiation (*R<sub>n</sub>*), Bowen Ratio (*B*), Latent Heat and Sensible Heat (*H*) Observed at Different Stages of Rice During *Rabi* 2008-09

When the Bowen ratio approaches zero, then almost all the energy available is used in evapotranspiration. In case of diurnal variation of Bowen ratio during panicle initiation (PI) stage it was maximum at 11:00 Hrs IST (0.875) and minimum at 9:00hrs IST (0.1), during heading (HD) maximum Bowen ratio was observed at 10:00 Hrs IST (0.771) and minimum at 12:00 & 9:00 Hrs IST (0.168) and during physiological maturity (PM) maximum and minimum values for Bowen ratio (B) are observed at 16:00 (0.595) and 10:00 Hrs (0.14) of IST respectively. When the mean values for diurnal variation of Bowen ratio were considered the increase was progressive from 9:00 Hrs IST to 14:00 Hrs IST was observed and maximum value was observed at 14:00Hrs IST and minimum value for Bowen ratio was observed at 9:00Hrs IST. (Table.2).

Hourly Intervals	PI	HD	PM	Mean
9:00	0.1	0.168	0.404	0.27
10:00	0.322	0.771	0.14	0.323
11:00	0.875	0.352	0.244	0.45
12:00	0.685	0.168	0.275	0.498
13:00	0.348	0.175	0.379	0.449
14:00	0.218	0.556	0.413	0.616
15:00	0.191	0.447	0.346	0.299
16:00	0.3	0.401	0.595	0.328

Table 2: Diurnal Variation of Bowen Ratio (B) in Different Stages of the Rice During Rabi 2008-09

### 3.2 Variation of Energy Balance Components

Net radiation was maximum (12.18) during the heading (HD) stage and minimum (8.23) in just transplanted crop. In case of sensible heat flux maximum (5.01) was observed during physiological maturity (PM) and minimum (1.272) in just transplanted crop and latent heat flux was maximum (7.36) during heading (HD) and minimum (6.62) during panicle initiation (PI) stage (Table1. & Fig.1).

### CONCLUSION

From this study, it can be concluded that maximum LE was observed during HD stage, which is the peak biomass accumulation stage. The management practices like selection of crop variety, water and nutrient management practices need to be worked out for converting available net radiation towards the higher biomass production

### REFERENCE

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