

# Assessment of the date of panicle initiation for the rice (*Oryza sativa* L.) using normalized difference vegetation index (NDVI) trends

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## Abstract

Determining the date of rice panicle differentiation is crucial for the management of nitrogen-fertilizer application that affects yield and quality of grain. When the length of the spikelet is found to be 0.2 cm, the nitrogen fertilizer should be applied within 2 days. In this study, the rice variety, KH147, was selected as the target variety. Pot experiments were designed for collecting the spectral data of the canopy in rice by using SpectraPen SP-100 (range 640-1050 nm, Photon Systems Instruments, Czech) from planting. Two wavebands (780 nm and 700 nm) was selected to calculate normalized difference vegetation index (NDVI) from planting. The quadratic polynomial regression model was used to construct the model of the trend of NDVI between tillering and panicle initiation stages. There is a tendency in the slope of the quadratic polynomial regression model to begin to decrease at the panicle initiation stage. The study results indicated that the NDVI trend of the canopy in rice seems to be correlating with the entrance of reproductive phase. NDVI could be a useful indicator to assess the date of panicle initiation when applying nitrogen-fertilizer.

## Materials and Methods

**Rice cultivar :** Kaohsiung147 (KH147)

**Transplanting date :** 2019.01.03 (Group 1) and 2019.01.17 (Group 2)

**Canopy reflectance acquisition :** SpectraPen SP-100 (range 640-1050 nm, Photon Systems Instruments, Czech) (Fig. 1)

**NDVI calculation :**

$$NDVI = \frac{R_{780} - R_{700}}{R_{780} + R_{700}}$$

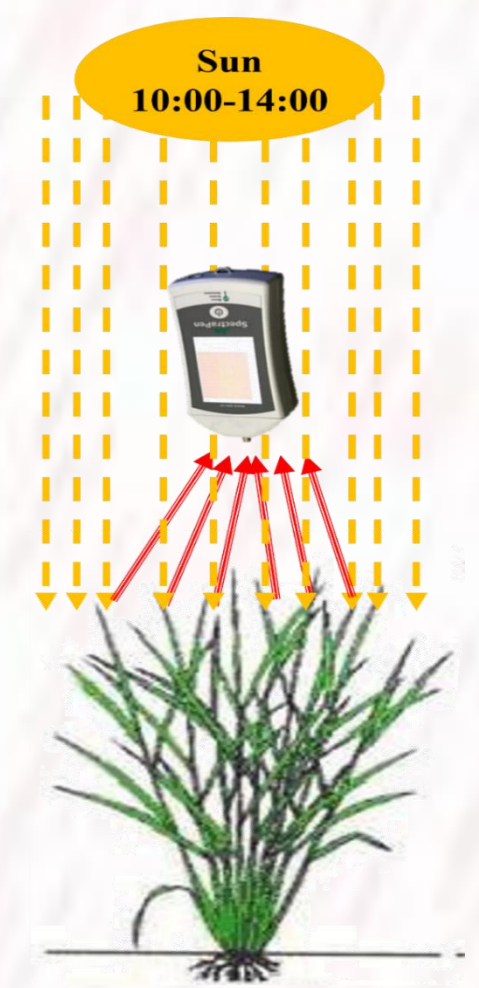


Fig. 1. Schematic diagram of canopy reflectance acquisition

Table 1. General concept of days after transplanting (DAT) of rice plant development in calendar days .

Stages	Tillering initiation	Tillering	Maximum tillering	Panicle initiation	Booting	Heading
DAT	I: 0~15	I: 15~30	I: 50~60	I: 65~75	I: 80~90	I: 85~100
	II: 0~10	II: 10~20	II: 35~40	II: 45~50	II: 60~65	II: 65~70

(Hualien District Agricultural Research and Extension Station, COA)

## Results

According to the calendar days, panicle initiation (PI) should be occurred between DAT65 and DAT75 in the first crop season (Table 1). However, in our study, PI was found in DAT60 in group 1 and DAT56 in group 2. Moreover, in the case of group 2, green ring was appeared but without the panicle in DAT51, and the panicle was found to be 0.3-0.5 cm in DAT60 (the end of panicle initiation). The results indicated that evaluating the PI stage by the calendar days was not accurate. In addition, the plant old leaves dramatically turned yellowish and senescence during the period of green ring appeared and panicle initiation ended (Fig. 2). The result is also the same as the trend of NDVI. There is a tendency in the slope of the quadratic polynomial regression model to begin to decrease at the panicle initiation stage (Fig. 3-4).



Fig. 2. Appearance changes of group 2 in DAT49 (a), DAT51 (b), DAT53 (c), DAT54 (d), DAT57 (e), DAT60 (f). Green ring appeared (a-b); Panicle initiation (c-e); The end of panicle initiation (f).

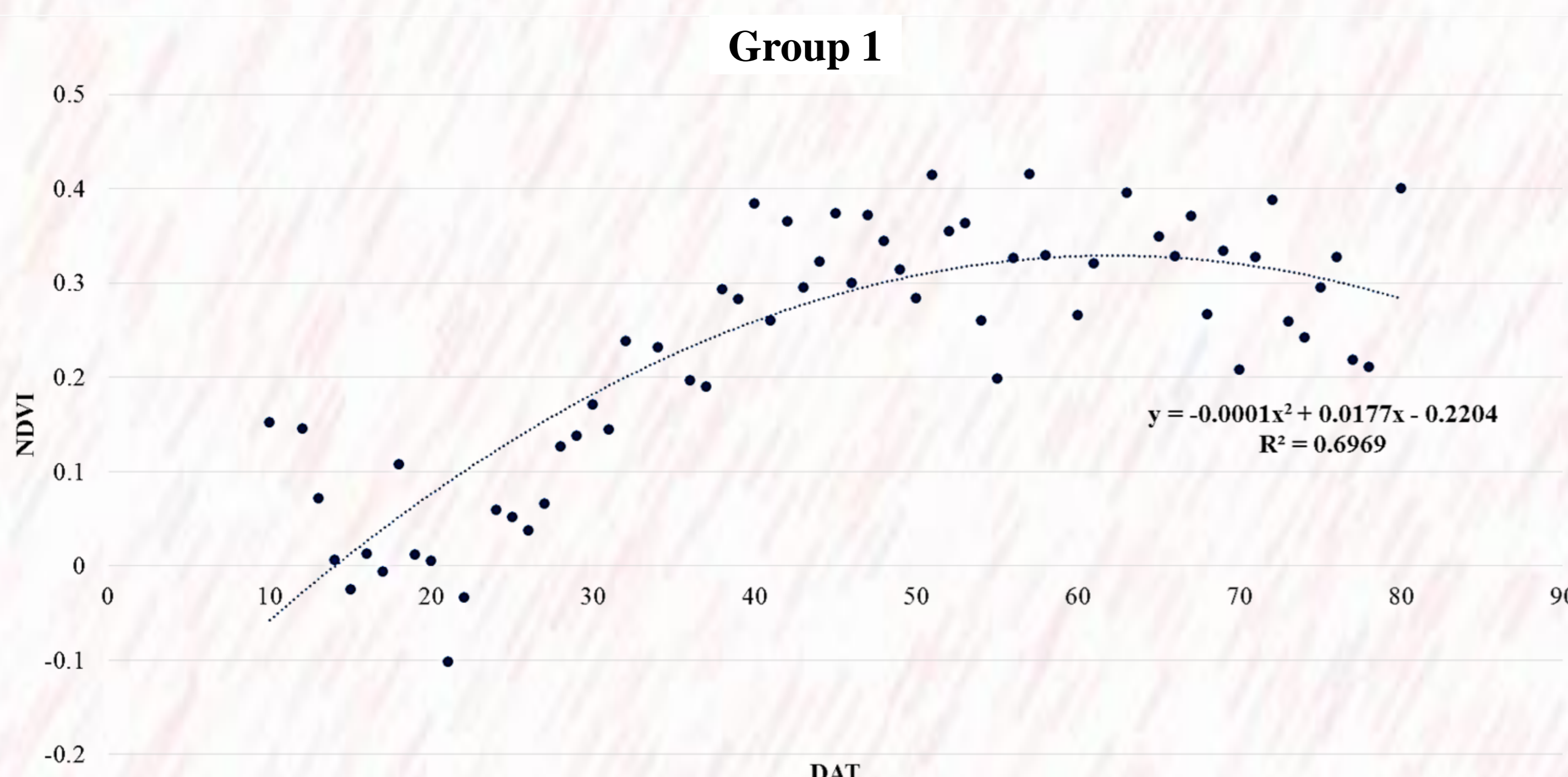


Fig. 3. Regression model of group 1

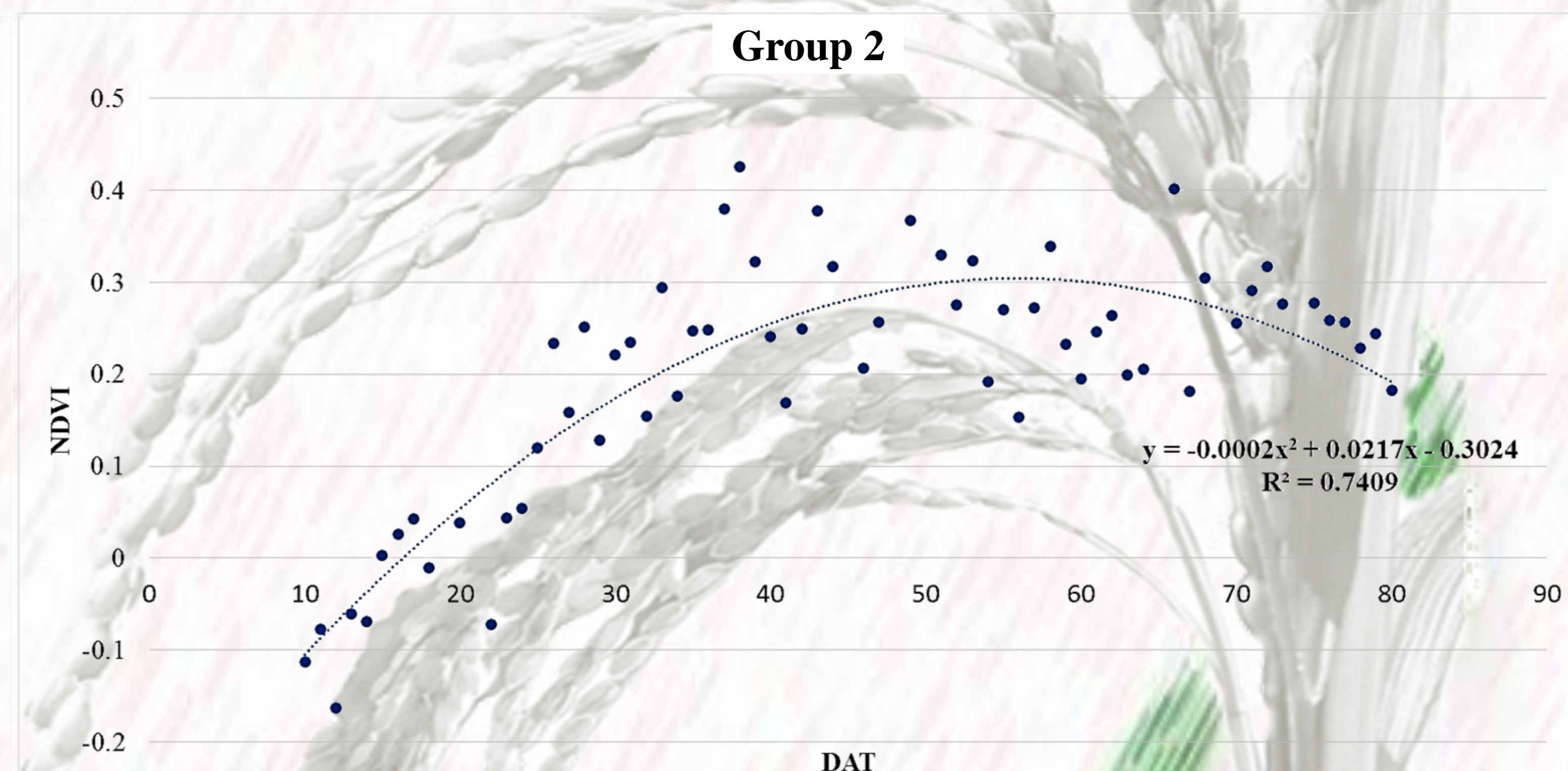


Fig. 4. Regression model of group 2

## Conclusions

The study results indicated that the NDVI trend of the canopy in rice seems to be correlating with the entrance of reproductive phase. NDVI could be a useful indicator to assess the date of panicle initiation when applying nitrogen-fertilizer.