The analysis of the cultivation status of the upland crops in the paddy field using unmanned aerial vehicle

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Abstract

Recently, the South Korean government encourages the cultivation of upland crops in the paddy field to maintain an adequate level of rice production and then to balance the demand and supply of rice. This is mainly because the rice consumption per capita per year has continued to decline from 135 kg in 1979 to 61.9 kg in 2016, although the rice production was relatively stable. As a result, the rice overproduction became a big social problem. As a part of that, various upland crops such as soybean, maize, minor cereals and forage crops are planted in the paddy field 10 years ago. The cultivation of these crops may settle the problem of short supply and mass import of the crops to some extent. However, a systematic remote observation of upland crops in the paddy field is very scarce. This study investigated the cultivation status of upland crops and any changes of crop harvesting in the paddy field by using an unmanned aerial vehicle (UAV). Also, we analyzed the kind of upland crops and cultivation area in the paddy field by utilizing time series observation images. A fixed wing UAV is used for the investigation. This is because it is easy to use the flight operation and to control flight management software, and it can automatically cope with various emergency states such as a strong wind and battery discharge. The material of UAV is expanded polypropylene, which has an advantage of less equipment damage and risk during takeoff and landing. We acquired observed images in Buljeong-myeon, Goesan-gun, Chungcheongbuk-do, South Korea by using fixed wing UAV in 2015 and 2016. The total investigated area reaches 6,045 ha, and among them the agricultural area was 1,377 ha. For the next step, we created an orthoimage from all images taken using Pix 4D mapper program. According to the results of image analyses in 2015, the paddy field covered total 577 ha (75.9%) with crop plant. The cultivation area of beans, ginseng, maize, tobacco and peach was 256 ha (36.6%), 63 ha (9.2%), 37 ha (5.4%), 31 ha (4.5%) and 27 ha (3.8), respectively. And in 2016, the total covered area was 586 ha (77.1%), and it was comprised of 253 ha (35.5%), 88 ha (12.3%), 29 ha (4.1%), 22 ha (3.1%) and 32 ha (4.5%) in the same order. In this study, we focused on identifying the paddy field which was converted to the cultivation of upland crops by using UAV. And, it has been indicated that the cultivation area of rice decreased from 141 ha in 2015 to 127 ha in 2016, although that of ginseng increased by 25 ha. As a result, it is expected that a lot of paddy field could be replaced by high-income crops such as ginseng and fruit tree (peach) instead of relative low-income rice. More specific and widespread research on the remote sensing in the paddy field needs to be done

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