For aerial images, vegetation index is often used to extract green vegetation. Vegetation index is usually used to reflect the difference between vegetation in visible light wave, near-infrared band reflection and soil background, which are used to describe vegetation growth status. There are hundreds of vegetation index [1], but they are often analyzed in combination with remote sensing information, and can be directly extracted through high-resolution remote sensing images combined with vegetation indices. Common vegetation indices mainly include normalized vegetation index (NDVI), ratio vegetation index (RVI), and enhanced vegetation index (EVI). In our study, we used RGB images. According to the literatures, vegetation indices based only on visible light waves are relatively few, including ultra-green index (EXG), normalized green-red difference index (NGRDI), red-green ratio index (RGRI), normalized green-blue difference index (NGBDI) modeled after NGRDI and VDVI modeled after NDVI index [2]. The vegetation index calculation formula of visible light wave is shown below:

$$EXG = 2 \times G - R - B \tag{1}$$

$$NGBDI = \frac{G - B}{G + B} \tag{2}$$

$$NGRDI = \frac{G - R}{G + R} \tag{3}$$

$$VDVI = \frac{2 \times G - R - B}{2 \times G + R + B} \tag{4}$$

$$RGRI = \frac{R}{G} \tag{5}$$

We tested these indexed in our images shown in Fig. 1

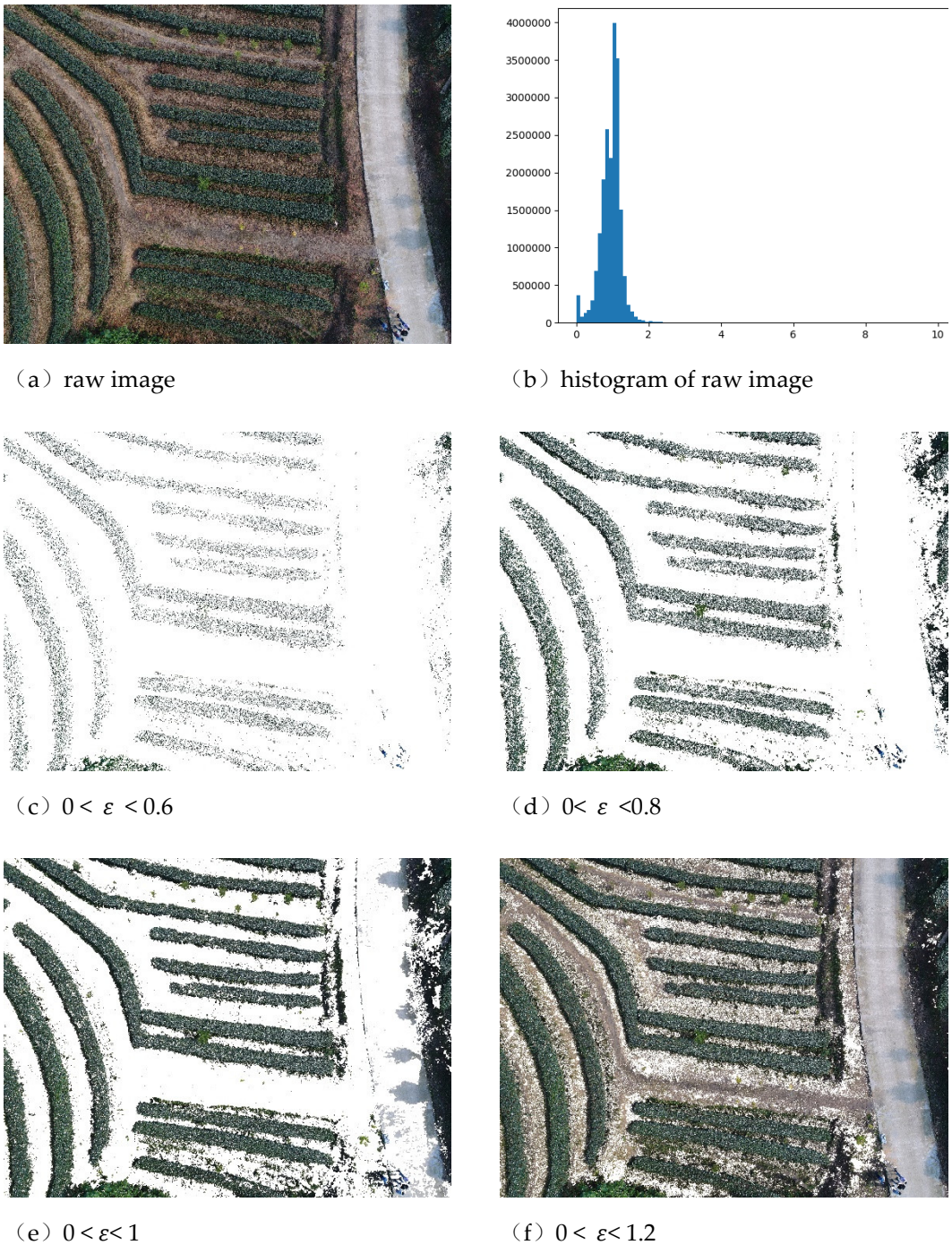
（a）raw image （b）VDVI （c）NGBDI

（d）ExG （e）RGRI （f）DGRDI

Figure S1. extraction examples by vegetation indexes.

From Fig.1(b)(c)(d, it is known that VDVI, NGBDI, ExG didn't perform well on the plant segmentation. There is too much noise on the images which made it hard to extract information from the images. In Fig.1(e)and(f), the image nosie is less. However, in Fig.(f), it produced shadow on the roads pixels. So we decided to choose RGRI index for further analysis.

Then we compared different threshold value ε to extract tea tree pixels. The test results are shown in Fig.2



（a）raw image　　（b）histogram of raw image

（c）$0 < \varepsilon < 0.6$　　（d）$0 < \varepsilon < 0.8$

（e）$0 < \varepsilon < 1$　　（f）$0 < \varepsilon < 1.2$

Figure S2. RGRI index extraction effect of different thresholds

By Fig.2, tea tree among RGRI index are mainly distributed in low threshold. If we use a big threshold value, it will contain many other approximate interference information. However, if the threshold value is too narrow, we may lose tea tree information. Besides, some trees and weeds and tea with the interval of distribution and its similar. In the image of tea garden, due to the uneven distribution of tea trees, the distribution of many trees in the middle of the road, and other green similar disturbances photographed in the aerial image, it is difficult to distinguish the visible light wave image containing complex content only by using the above

index.

Therefore, it is not enough to extract complex information only through the above indexes. In order to extract tea tree information in a better and more complete way and eliminate other similar contents at the same time, a variety of feature models including color and texture are constructed in our study.

References:

[1]. Lu, J.Z., et al., Using hyperspectral imaging to discriminate yellow leaf curl disease in tomato leaves. Precision Agriculture, 2018. 19(3): 379-394.

[2] Wang X, Wang M, Wang S, et al. Extraction of vegetation information from visible unmanned aerial vehicle images [J]. Transactions of the Chinese Society of Agricultural Engineering, 2015, 31(5):8.