

○Masatoshi Kamei, Yoshinori Tamura and Tadayuki Suzuki

(Kao Corporation Eco-innovation R&D)

### 1. Introduction

It is said that recent problems of agricultural formulation and application are reducing cost, environment safety, and laborsaving. There is a method of increasing the effect of agricultural chemicals by the adjuvant as an approach that solves these problems, and we have wrestled these problems to achieve the reducing pesticide (such as reduction of concentration, spray frequency, and spray volume). We have studied the superior wetting performance by the improvement of the action on the cuticle of the plant surface by using the interfacial control technology in our laboratory, and the new adjuvant (Polyoxyalkylene ether type surfactant (KP-5134)) have been developed. It is reported that KP-5134 used as a tank mix type adjuvant increase the herbicide effect (rain-fastness and reducing pesticide), and the mechanism analysis.

### 2. Methods

**Wetting performance test:** The barnyard grass leaf in 5-10 leaf stages was gathered, droplet 5 $\mu$ L was dropped on the leaf, and the wetting area after one minute was measured. Dilution rate of the glyphosate formulation is 160 times and KP-5134 is 1000 times.

**The herbicide test:** Spraying volume is 50L/10a, the dilution rate of herbicide (41% ai glyphosate IPA formulation) is 160 times and KP-5134 is 1000 times, and the herbicidal activity was measured by appearance about the tenth day by using the barnyard grass in five leaf stages. In case of rain-fastness, it was rained for ten minutes by strength of 30mm/h one hour later from spraying. In case of the reduced herbicide, the concentration of from 10% to 50% was decreased based on 160 times, and the spraying volume was constant.

**Penetrating test to cuticle membrane:** The permeability was evaluated by gathering the cuticle membrane of the tomato fruit without the stoma by the enzyme separation, and measuring the concentration of the glyphosate that penetrated from the cuticle membrane by the vial examination according to Fick's law.

**Penetrating test to stoma:** The barnyard grass leaf was washed by water after immersing the leaf in 0.1M silver nitrate solution for ten minutes, and black precipitation by the silver nitrate at the around stoma was observed with the microscope.

**Penetrating test into plant:** The amount of penetrating to the plant was simply measured the difference glyphosate of washing amount from dropping amount, by dropping the glyphosate 4400ppm solution of 5 $\mu$ L (two places) to the barnyard grass leaf under growth, wash the surface of the leaf in water after ten minutes and 24 hours, and measuring the glyphosate contained in the wash solution.

### 3. Results and discussion

The 5 $\mu$ L water droplet showed 3mm<sup>2</sup> wetting area on barnyard grass of the surface hydrophobicity where the contact angle of water showed 130 degrees or more by water.

Glyphosate formulation showed 5mm<sup>2</sup>, POE(6) Sec.C11-C15 ether (comparison product) which was ordinary wetting agent showed 30mm<sup>2</sup>, and KP-5134 which was the high wet performance adjuvant showed 320mm<sup>2</sup>. The effect of agricultural chemicals was increased by using KP-5134 as an tank-mix adjuvant of the glyphosate, and showed the possibility of the rain-fastness for one hour, and 50% reduction of herbicide was shown. The effect of cuticle membrane permeability of glyphosate was shown about twice by adding KP-5134 compared with a glyphosate formulation only as a result of the penetrating test to cuticle membrane. Moreover, the performance of penetrating from stoma was increased as a result of stoma penetrating test by the silver nitrate. The penetrating rate into the plant of the glyphosate was 1.4% in case of glyphosate formulation, comparison product was 3.8%, and KP-5134 was 9.0% ten minutes after application. Glyphosate was 30%, comparison product was 40%, and KP-5134 showed high permeability was 50% by 24 hours later, by these penetrating effects from stoma and cuticle membrane. The surface tension of both the comparison product and KP-5134 are 26 mN/m, and a superior wetting and penetrating performance increased effects of agricultural chemicals, seems to be the effects of not only the surface tension but also the interface control.

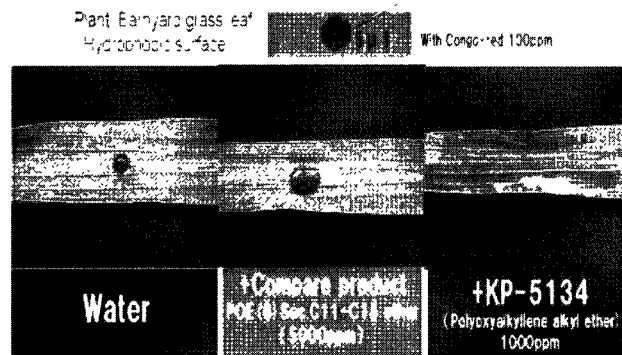


Fig.1 Effect of wetting by new adjuvant on hydrophobic leaf surface

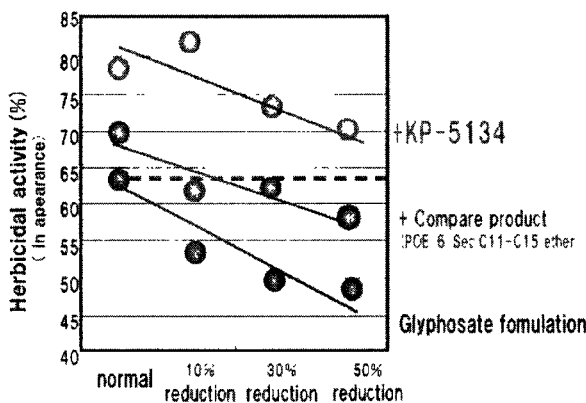


Fig.2 Effect of herbicide reduction

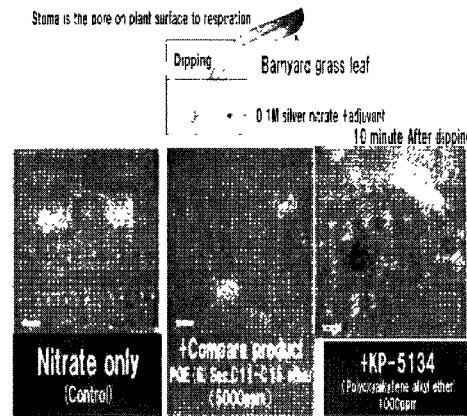


Fig.3 Stoma penetration test