

# Case Study

## Organic farming

BASF's NOR<sup>®</sup> technology helps farmers cultivating under organic-certified production system to grow safely and profitably in their social, ecological and economical sustainable agroecosystems.

Organic farming is a crop and livestock production system that is rapidly developing worldwide. End consumers in North America, Europe and Japan requiring healthier food have influenced this rapid growth. Farmers growing organic vegetables and fruits in intensive agriculture need greenhouse covers with optimum optical properties for crops and natural pollinators, with lasting protection against the challenging conditions they are exposed to. The market for organic food is growing rapidly. In 2019, more than 70,000,000 Ha (170,000,000 acres) worldwide were farmed organically, representing 1.4% of total world farmland.

### Need of sulfur-resistant films

Ecologically safe elemental sulfur-based compounds are approved in organic farming to prevent plant diseases and fertilize the soil. The stability of the films is crucial. One of the main reasons for unwished early degradation of films is caused by the presence of sulfur which is negatively influencing their stability. BASF's NOR<sup>®</sup> HALS has proved to be the outstanding technology to protect the greenhouse covers in contact with demanding sulfur and chlorine levels, and stress from UV light and heat. Products from organic farms are certified after a 3-year process of independent inspection of the farm to prove compliance with protocols and maintenance of organic standards. The greenhouse is exposed to pest invasion and farmers may lose the certification if the film degrades earlier than expected. The qualification process would have to be redone. NOR<sup>®</sup> HALS-based light stabilizers have proved to prevent early degradations of greenhouse

covers and thus help organic farmers to keep a solid balance sheet and their organic certification. Environment protection and material recycling are principles of organic farming.

By extending the lifetime of agricultural plastics, BASF's NOR<sup>®</sup> technology contributes to reducing both plastic waste and farmer's cost. In the Italian market, BASF demonstrated that the amount of polymer needed per Ha with NOR<sup>®</sup>-based films was reduced by 58% if the film's duration increased from 1 to 3 years (12 to 36 months) and by 27% when increased from 2 to 3 years (24 to 36 months). The farmer's film cost was also reduced, by 50% and 25% respectively. At the end of their lifetime, films still had good mechanical properties and thus were suitable for recycling.

### Optimum light for crops

The stabilization system of the film has an impact on organic crop's quality and quantity. BASF ran agronomic tests at Estación Experimental Cajamar in Almería (Spain) from 2012 to 2014 to evaluate the quality and commercial yield of tomato, pepper, cucumber and melon under two commercial films: based on NOR<sup>®</sup> and on NiQ. Both films had the same characteristics (polymer, layers, thickness, duration, fillers) and were exposed to equal conditions in terms of greenhouse structure and surface, substrate bags, drip irrigation, white washing and treatments (S-burnt-based).






The results proved that NOR<sup>®</sup>-based films have higher transmittance with consequent average increase of 7% solar radiation and turned-into average, +7.8% commercial yield and additional 3,900€/ha earnings. Tomato had higher sugar content and pepper was harvested earlier than expected. Considering the resistance of the films, the NiQ film broke before its targeted duration due to thermal stress and accumulated high levels of sulfur, while the NOR<sup>®</sup> film remained in good condition at the end of its theoretical lifetime.



**Optical properties of films and impact in solar radiation (%)**  
**Agronomic trials at Cajamar Station comparing NOR<sup>®</sup> film and NiQ film**

Increased solar radiation under NOR<sup>®</sup> film (% per crop)

- + 6.3% 
- + 6.6% 
- + 3.7% 
- + 10.4% 