A mathematical model of a heat pump fruit dryer was developed to study the performance of heat pump dryers. Using the moisture content of papaya glace' drying, the refrigerant temperature at the evaporator and condenser and the performance, was verified. It was found that the simulated results using closed loop heat pump dryer were close to the experimental results. The criteria for evaluating the performance were specific moisture extraction rate and drying rate. The results showed that ambient conditions affected significantly on the performance of the open loop dryer and the partially closed loop dryer. Also, the fraction of evaporator bypass air affected markedly on the performance of all heat pump dryers. In addition, it was found that specific air flow rate and drying air temperature affected significantly the performance of all heat pump dryers.